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CONTENTS

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For complete table of contents see advertising page xi.

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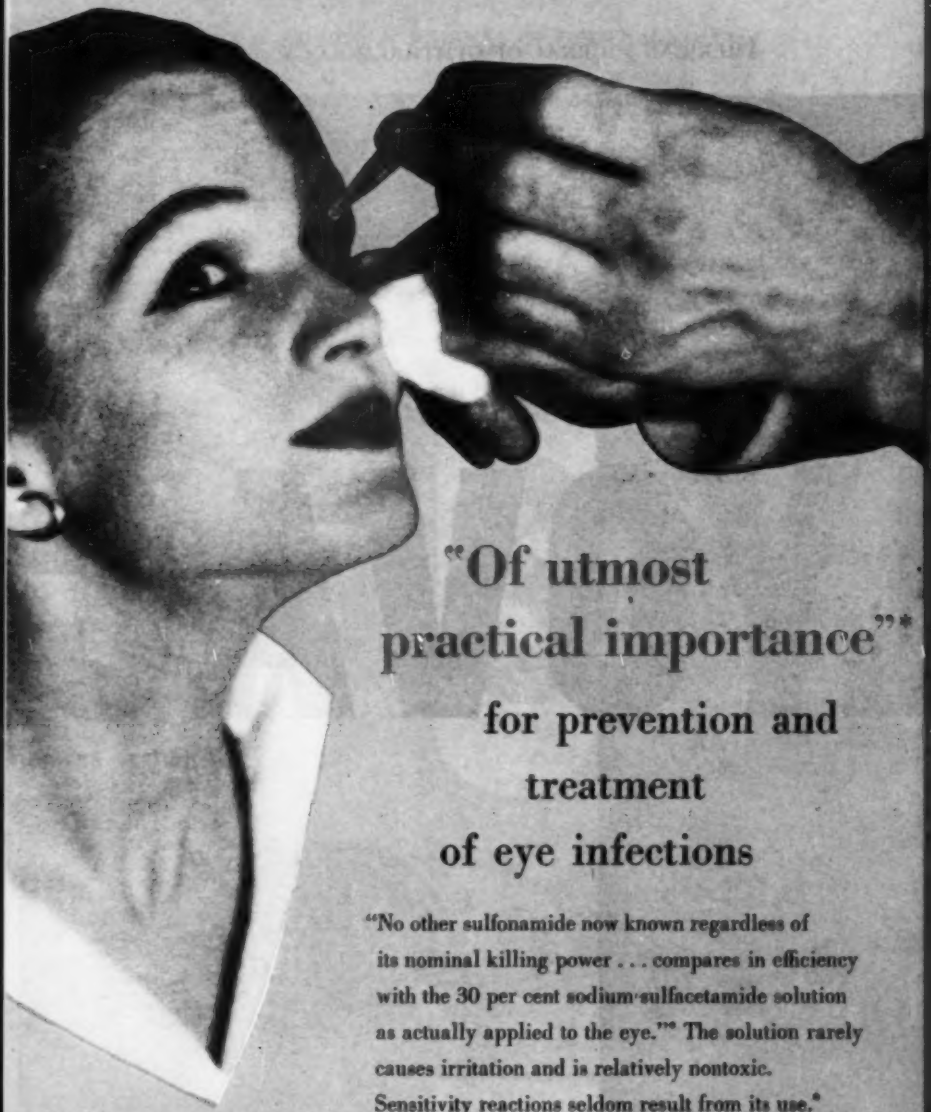

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SERIES 3 · VOLUME 35 · NUMBER 11 · NOVEMBER, 1952

CONTENTS

Color plates illustrating article by Count Hermenegildo Arruga inserted between pages 1576-1577

AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 35 NOVEMBER, 1952 NUMBER 11

CERTAIN CONSIDERATIONS OF THE SURGICAL TREATMENT OF RETINAL DETACHMENT*

COUNT HERMENEGILDO ARRUGA
Barcelona, Spain

Though many years have passed since Gonin invented the surgical treatment of retinal detachment and although the operative technique of this is not difficult, yet this technique is by no means widespread and there are in all countries a number of colleagues who avoid this operation, although they are expert surgeons who include all other ocular operations in their field. This situation is due to several factors.

The first of these is the diversity of clinical types of this disease which necessitates a different technique for each of them. After visiting several ophthalmic centers to watch operations, an oculist will acquire a standard procedure for such operations as cataract, glaucoma, squint, and so forth. In detachment, however, he finds considerable variations in technique and, therefore, does not develop a standard plan of procedure.

The reason for this is that the operative technique of retinal detachment cannot be standardized. Another reason is the relatively small number of these operations, which means that oculists, unless they are in a large city or a large hospital, do not have the opportunity of seeing many of them. This limits their experience in this branch of surgery.

The higher incidence of myopia in Europe, especially in the Latin countries, than in North America means that the condition is commoner there.

Further, another factor of great importance to be found is the difficulty of examining the fundus where the media are opaque. This is of great importance in the United States where few surgeons use indirect ophthalmoscopy. In order that the ophthalmoscopic examination should be complete and efficient, it is necessary that both methods, direct and indirect, but especially the latter, be employed.

As Gonin said, "The instrument that cures retinal detachment is the retinoscope." His pupils propagated this truth, but it is difficult for many colleagues to accustom themselves to long and repeated examinations of the fundus. There are, indeed, cases which test the oculist's patience, but the work in the dark room is far more important than that which is done in the operating theater, as the efficiency of the latter depends upon the perfection of the former.

These concepts are well known but do not have the influence that they should. Those who have a large experience with retinal detachment will confirm that many failures are due either to defective localization of the tears or to an excess of diathermic action. The latter follows from the first, that is to say, where tears are badly localized a more extensive diathermic application is made. This is easy for the surgeon and hard on the patient, as the larger the surface of choroid coagulated, the greater the local reaction and the smaller the surface of healthy choroid remaining for reabsorption of the subretinal fluid. However considerable the drainage, a certain amount of this always remains after operation.

* Presented at the 56th annual session of the American Academy of Ophthalmology and Otolaryngology, Chicago, October, 1951. (Address of the guest of honor.)

In view of the fact that many ophthalmologists have only a limited experience with this condition, it remains for those of us who have had a larger experience to hand on the results of this experience that we believe might be useful to them.

In this paper, I will attempt to classify the different types of retinal detachment in order to systematize as far as possible the necessary procedure.

Finally, I will give the approximate percentage of cures obtained, though this depends on many factors, such as the size of the tears, the turbidity of the media, the age of the patient, the duration of the disease, and, mainly, the improvement with rest. I shall mention two percentages of cure for each type. The first refers to those cases which did not improve with binocular bandage and rest in bed, the second to those which did improve with rest.

In many of the described types of retinal detachment, the tears may be invisible either owing to their small size or because they are hidden by folds or vitreous turbidity. There is also the possibility that they do not exist, the detachment being due to choroidal exudation. However, tears may exist in cases of choroidal exudation. The mechanism in such cases is as follows:

At one point in old chorioretinitis the retina adheres to the choroid, the exudation elevates the retina and tears it, and a small piece of retina remains adhered to the choroid. It is probable that tears of the macula are produced by this mechanism. The tear is circular, but here the operculum is not seen floating in the vitreous as happens in circular tears of other zones of the retina where the operculum is adherent to the framework of the vitreous.

Trauma has not as much importance as was formerly believed in the etiology of the detachment, as the retina tears if it is degenerated or atrophied. It is therefore convenient, even in cases where the traumatic factor exists, to eliminate other possible causes, especially focal sepsis, as the two main causes of retinal detachment, myopic and senile degeneration, are not treatable.

Detachments of the Types 1, 5, 9, and 10, if not operated upon, are displaced downward because the subretinal fluid, its density increasing with time, descends to the inferior pole and the separation of the superior retina becomes smaller. If the tear is large (type 6, 8, 11, 13) and one does not operate, the detachment extends in all directions, as a rule, but not downward with reapplication of the superior retina, because here the density of the subretinal fluid does not increase much, as there is a wide communication with the vitreous.

When there is a small amount of subretinal fluid, pressure upon the globe is not necessary to expel it, nor is the injection of air into the vitreous. It might even happen that quite a large amount of subretinal fluid remains unexpelled and that a cure is attained. Cases are seen frequently with big retinal bulges which reabsorb with preoperative rest. Nevertheless, if there is a moderate amount of subretinal fluid, it is preferable to expel it.

The detachments which reach the oculist latest are the inferior ones, as they are the slowest to reach the macular region and the scotoma they produce is in the least sensitive part of the retina corresponding to the superior visual field hidden by the eyebrow. The detachments of the nasal zone are also slow to alarm the patient as they, too, reach the macula late.

Synthesis of the Basic Concepts of the Evolution and Treatment of Retinal Detachment

Whenever hemorrhagic opacities are present in the vitreous one must consider the possibility that they may be followed by retinal detachment.

When a detachment with a small tear increases in spite of rest, it is wiser not to operate, as the choroid may react with the subretinal fluid and, instead of absorbing it, exude more.

Rest implies binocular bandage as a rest

for the oculomotor muscles. This is more efficacious than rest for the body, though the latter, too, has value.

When nonperforating diathermy is applied at the beginning of the operation in order to obtain a white spot of coagulated retina for orientation, it is convenient, if there is subretinal fluid, to push the electrode against the sclera to depress it, as a white spot of coagulation would not be obtained without depressing the electrode. If the separation of the retina from the choroid is very extensive, the coagulation of the former is not attained.

Once the sclera and the choroid have been perforated to allow the subretinal fluid to exude, a certain amount of it does so, but if the globe is pressed or air is injected into the vitreous, it will be frequently observed that a further large quantity (which often astonishes the operator) follows it.

When the globe is pressed to obtain issue of subretinal fluid, one can see vitreous going out when puncture has been done exactly at the place of the tear. This is not a bad sign but, on the contrary, a good one, as adherence of the vitreous framework to the cicatrix on the wall of the globe contributes to maintenance of the retina at this point.

The injection of air is generally performed near the insertion of a rectus muscle, whose tendon is held by forceps in order to prevent the needle depressing the wall of the globe too much. It is convenient to make the puncture at about six or seven mm. from the limbus in the direction of the posterior pole and to inject a quantity of air sufficient to evacuate the subretinal fluid.

When diathermy has been applied to the zone of sclera corresponding to the tears, it is prudent to surround the intensely diathermized zone by a very slight diathermic action. This is to avoid relapses due to tractions in the border of the intensely diathermized zone, as slight diathermy produces a zone of retinochoroidal adhesion without the destruction of these membranes, which occurs when they are much coagulated.

Postoperative rest with both eyes bandaged takes eight days for the most favorable cases and perhaps three or four weeks for severe ones. The most convenient position according to the situation of the tears is still a matter of discussion. The really important thing is that the immobilization must be as perfect as possible.

The position of the head which would appear the most logical is that of rest on the side where the evacuating puncture has been done. In cases of superolateral or lateral tears with bulges in the inferior pole, if the puncture has been done in the inferior pole, as many of my colleagues do, the head should not be resting on the side where the tears were, because of the subretinal fluid which may remain after the operation and which, being more dense than the vitreous, will move to the zone of the tears and separate the retina from the choroid. If the evacuating puncture was made in the zone of the tears, then the patient's head may rest on the side where the tears were.

In severe cases and in cases of relapse during the first months after the operation, diathermic puncture followed by air injection may bring about a cure.

And here I conclude this paper, though I am afraid it contains nothing new for those who are experienced in retinal detachment. I will be very glad if it has at least been of some interest for those who are not very familiar with this branch of ophthalmology.

Legends for color plates

Figure 1. Incipient superoexternal detachment. This is the most frequent type, as 30 percent of all cases begin in this way. In the stage shown in the figure, the patient rarely consults the oculist. He does not become alarmed until the condition is more advanced, as he notices only a slight reduction of the visual field in the nasal region and a few photopsias.

Treatment. If the retinal prominence is not reduced, diathermy and puncture. If the prominence is reduced, diathermy without puncture. Cure, 85 to 98 percent.

FIGURE 2. *Case 1* after some days. In this stage we see most of these patients with this type of detachment, as it reaches the macular region and thus alarms the patient by the important loss of central vision.

Treatment. Rest in order to obtain as large a reapplication of the retina as possible, diathermy operation with puncture and expulsion of the subretinal fluid. Cure 80 to 95 percent.

FIGURE 3. *Cases 1 and 2,* further advanced. This is the appearance which Figures 1 and 2 take on if the patient neither rests nor has an operation.

Treatment. Rest until, if possible, the eye recovers the appearance of Figures 2 or 1. At this point, operative intervention. The operation should consist of diathermy and puncture, which should be done in the region of the tear, emptying the subretinal fluid by pressure or air injection. Cure, 50 to 80 percent.

FIGURE 4. Total detachment. This is a further advanced case of Figures 1, 2, and 3.

Treatment. Rest. If the detachment came on rapidly in spite of a small tear and is not reduced by rest, the prognosis is grave, as an exaggerated choroidal reaction is thus suggested. Rest must be continued and a search made for cause, mainly focal sepsis. If the detachment became total relatively slowly, that is, within about two to three months, the prognosis is not so bad. Reapplication may be obtained with rest, thus allowing an operation, although macular vision will remain diminished.

Treatment. Diathermy in the region of the tear and puncture with expulsion of subretinal fluid. Cure, 20 to 60 percent.

FIGURE 5. Detachment with superointernal or superonasal tear. This type is always less serious than those occurring on the outer side, as the optic nerve preserves the macula.

Treatment. Rest, lying on the side of the detachment in order to avoid movement of the subretinal fluid to the temporal side. Operation is employed when the retina has reached its maximum reapplication.

Treatment. Application of diathermy and expulsion of subretinal fluid. Cure, 60 to 95 percent.

FIGURE 6. Recent superior detachment with a big tear. When the tear in the superior hemisphere is large, the detachment rapidly becomes prominent and extensive, as the vitreous has a large opening through which to pass into the subretinal space. Reapplication with rest, is therefore, much more difficult.

Treatment. An attempt should always be made to improve the position of the retina with rest, but if there is no improvement after a few days, operate. It is useful in such cases, quite apart from the diathermy application in the region of the tear, to make a puncture in this zone and press on the eyeball so that some vitreous is evacuated after the subretinal fluid. The fixation of the vitreous structure at the exterior of the globe favors reapplication of the retina. Cure, 50 to 90 percent.

FIGURE 7-A. Recent superior detachment of ballooned type without visible tear. Though this may be a detachment due to choroidal exudation, the probability is that the tear is hidden by the prominent retina.

FIGURE 7-B. In this case one must not forget that the zone of the sclera which corresponds to the point where the tear is localized may be more anterior than that which appears in the ophthalmoscopic examination prior to the evacuation of subretinal fluid.

Treatment. Rest. Sometimes the tear then becomes visible with rest, as in Figure 7-B. If the tear remains invisible after rest, one must operate, employing a small puncture, a procedure which almost invariably makes the tear visible. In this way the diathermy can be placed in the proper position toward the end of the operation. Retinal fluid is expelled. Cure, 75 to 80 percent.

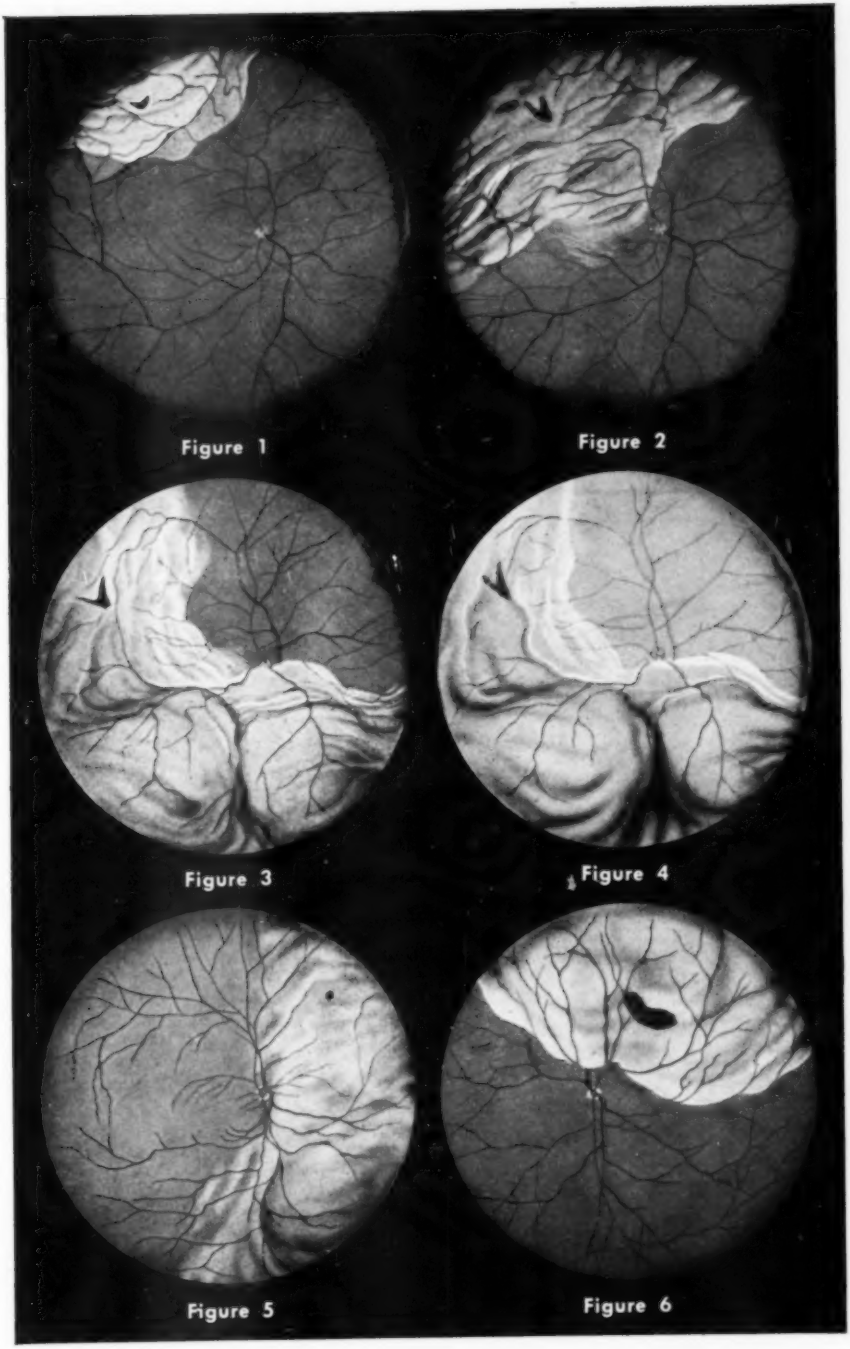

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

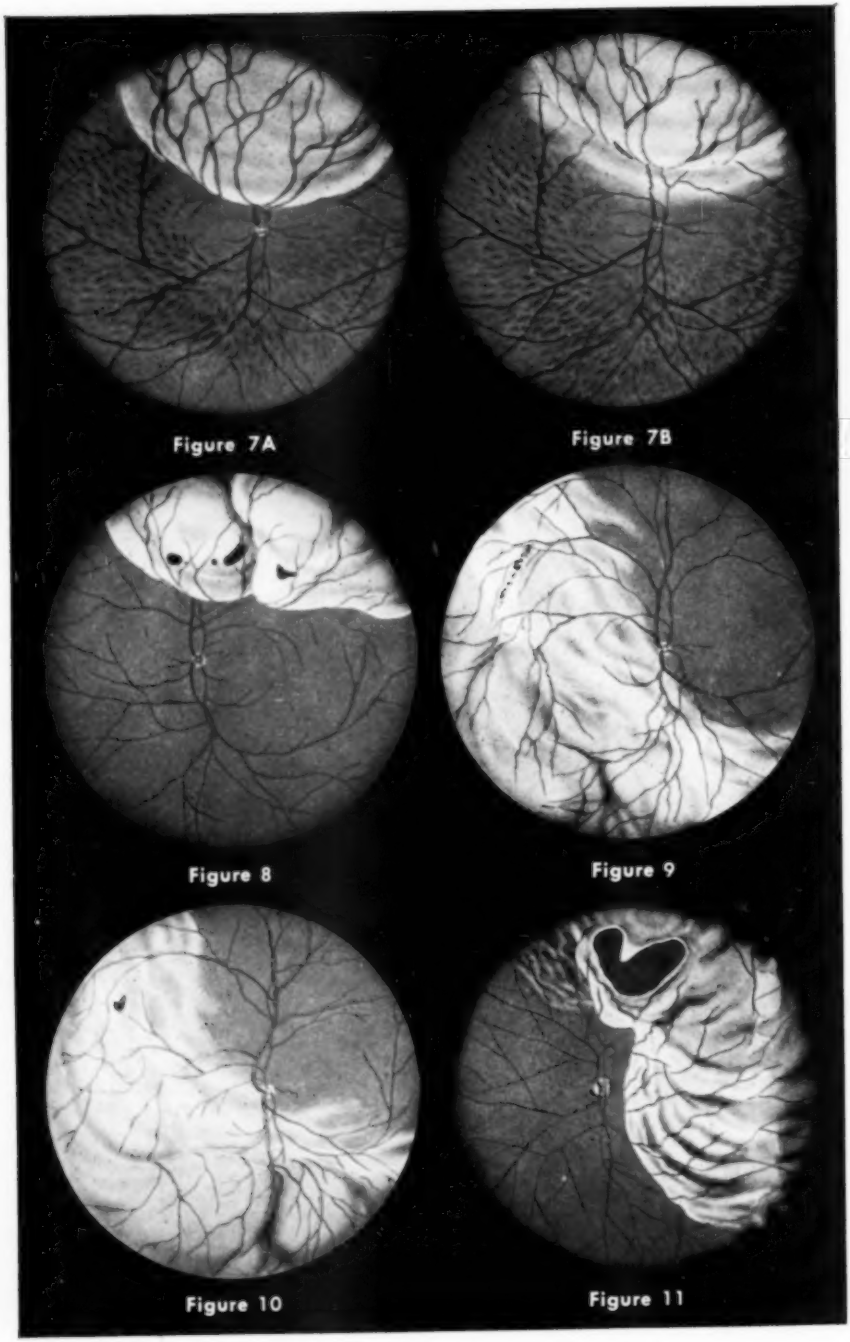

Figure 7A

Figure 7B

Figure 8

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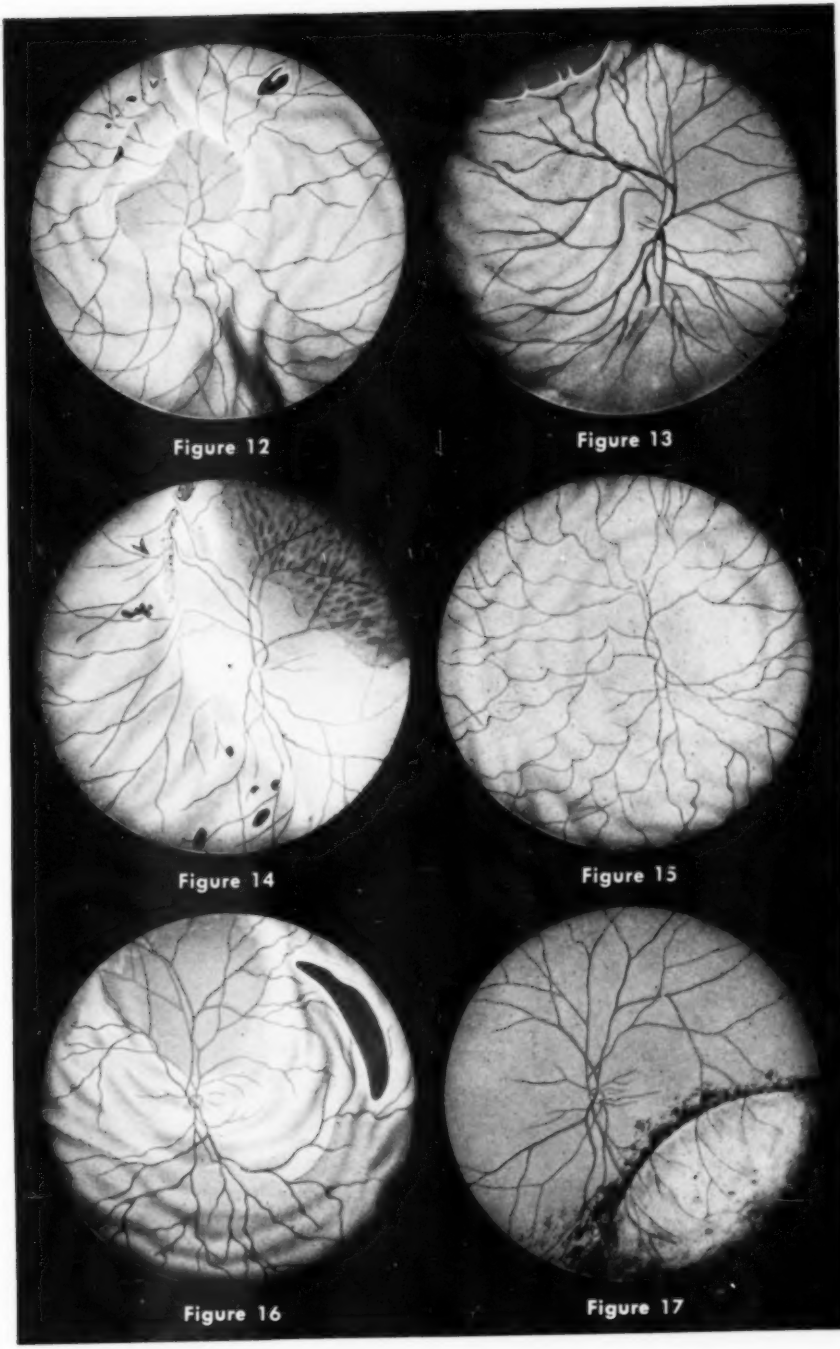

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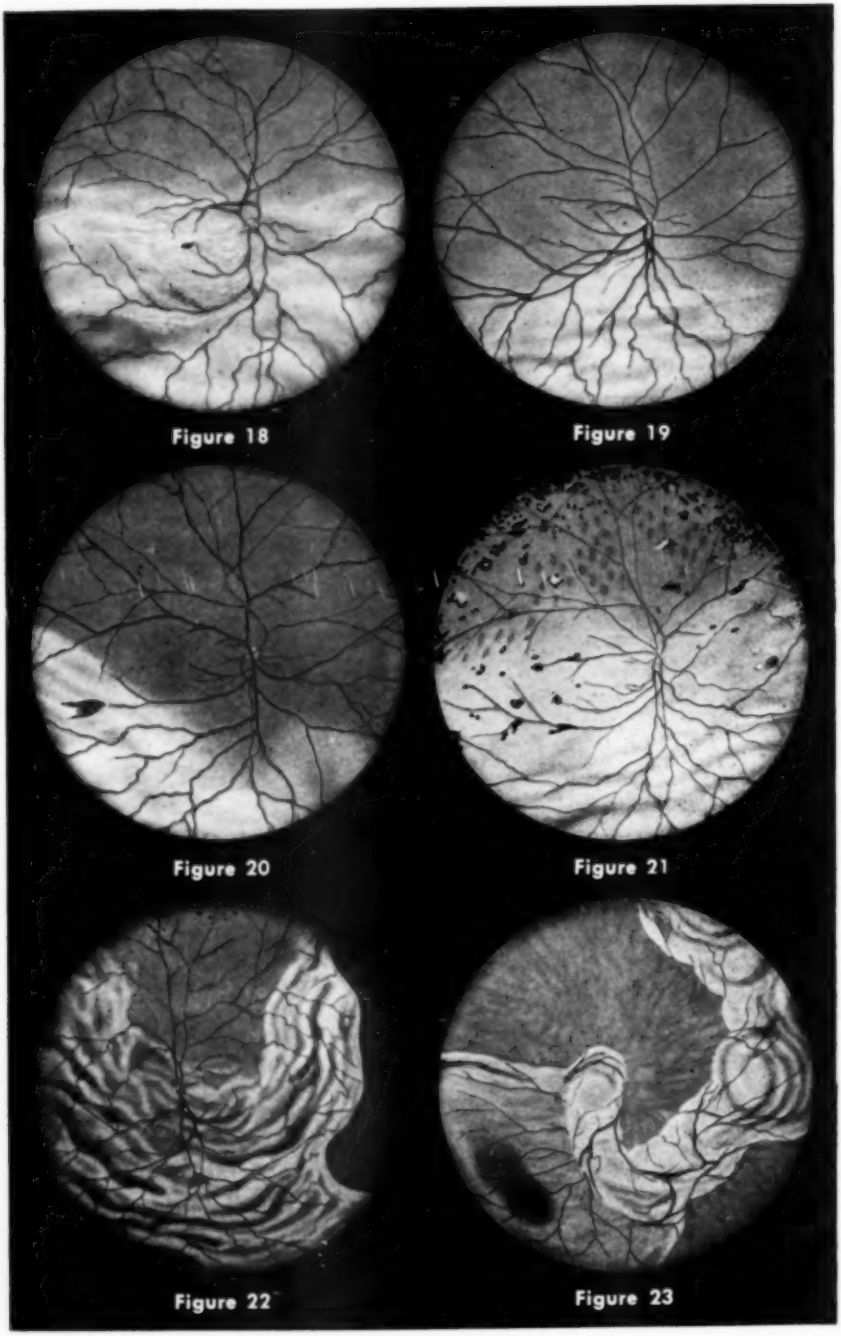

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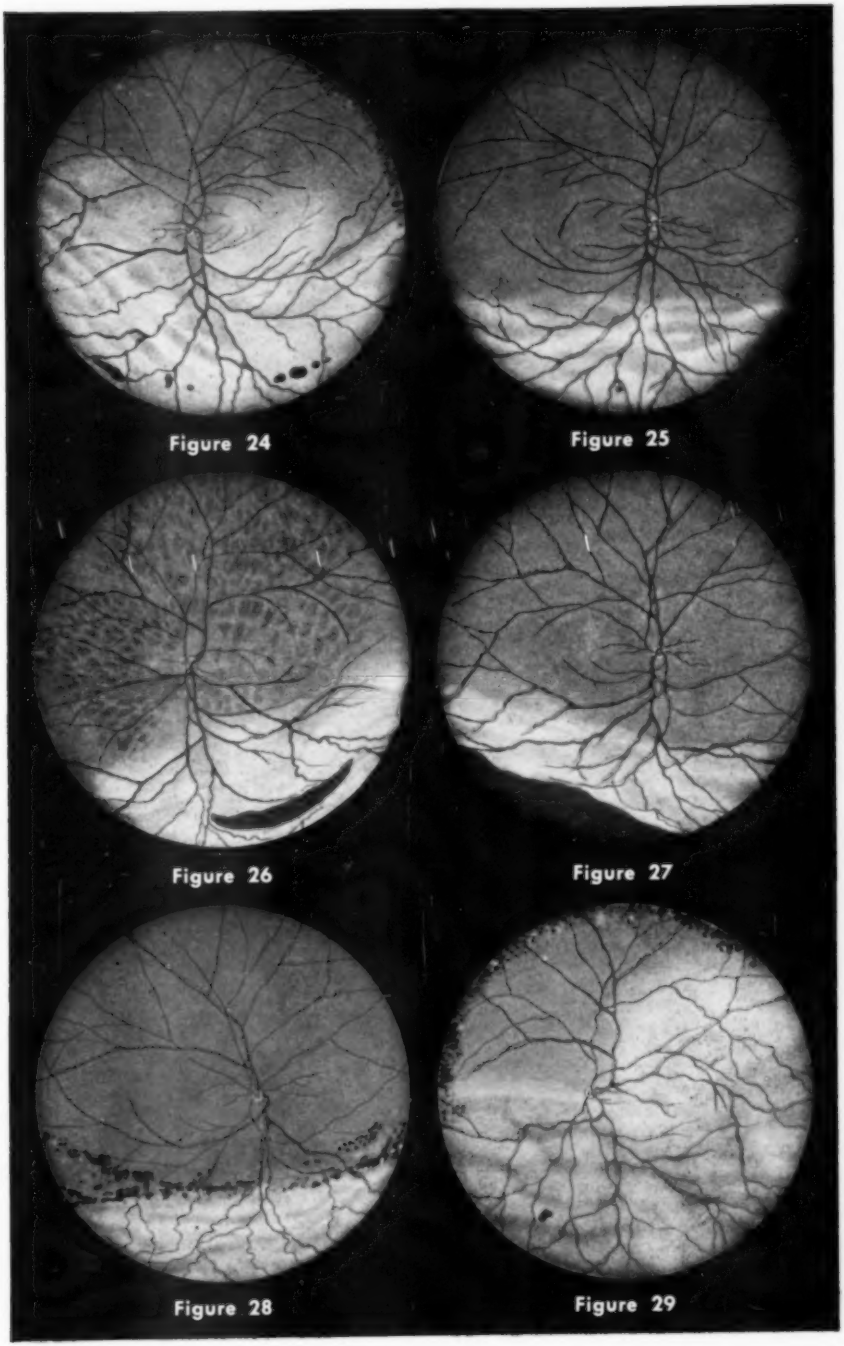

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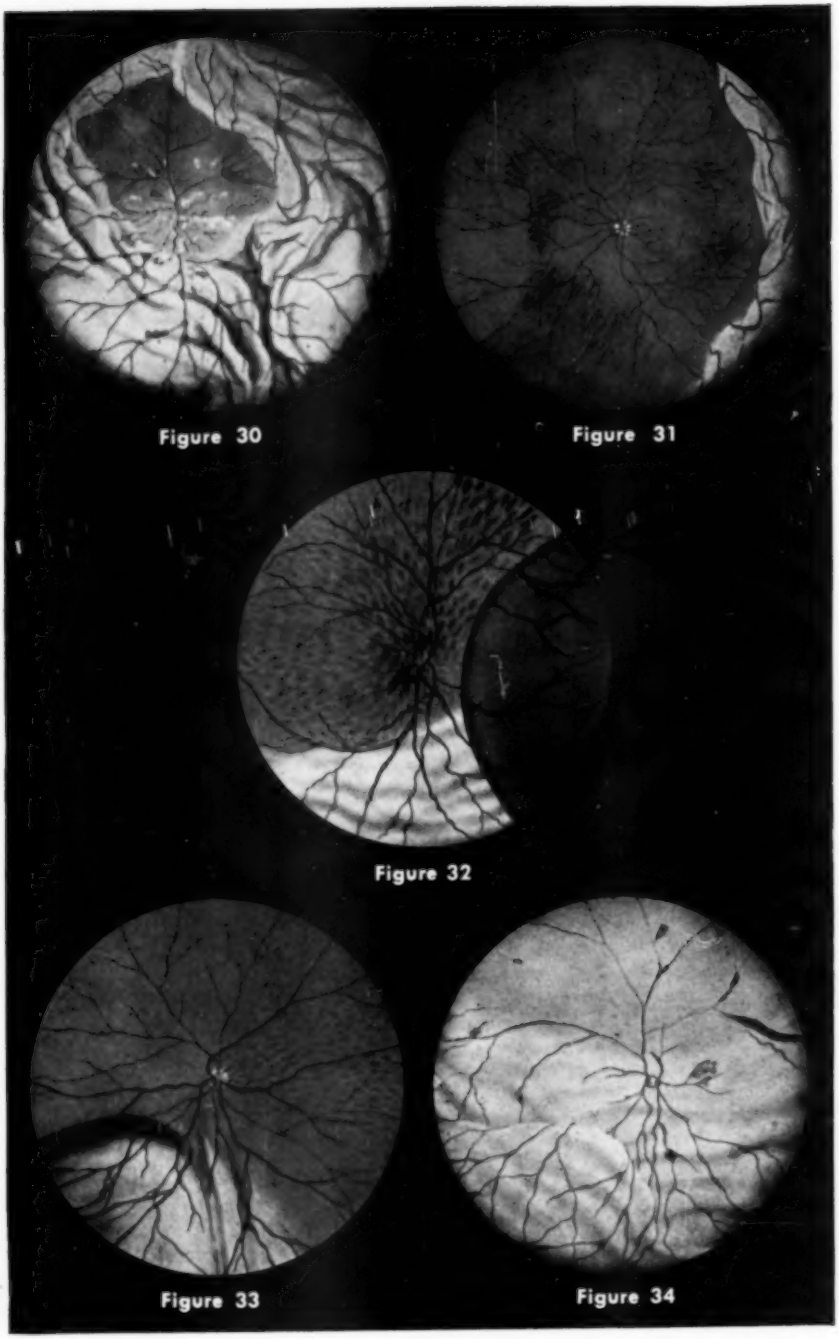

Figure 30

Figure 31

Figure 32

Figure 33

Figure 34

FIGURE 8. Recent superior detachment with several tears. This is a case similar to Type 6, but of greater gravity for two reasons: first, because the multiple perforations indicate great fragility of the retina and, second, because the operation is more laborious and obliges one to make an extensive diathermic application, thus diminishing the probabilities of cure.

Treatment. Diathermy at the zone of the tears and punctures with expulsion of the subretinal fluid. Cure, 30 to 70 percent.

FIGURE 9. Detachment of a few weeks' standing with small tears in a zone of reticulovacuolar degeneration in the superoexternal region. In spite of a long and narrow degenerated zone, the prognosis is benign, as the said zone is usually confined to a superoexternal sector in the equatorial region. The tears being very small, the detachment usually progresses very slowly. A similar degenerative lesion is often present in a symmetrical position in the fellow eye.

Treatment. Nonperforating diathermy and puncture if there was subretinal fluid after the rest. Cure, 70 to 90 percent.

FIGURE 10. Detachment of some months' standing with tear above and detachment below. When the tear is small, the detachment grows slowly. When after some weeks the density of the subretinal fluid increases, the fluid descends to the inferior hemisphere of the eye and the retina in the region of the tear approaches the choroid.

Treatment. Diathermy at the zone of the the tear with puncture in the same region and pressure or air injection in order to evacuate subretinal fluid. Cure, 50 to 80 percent.

FIGURE 11. Extensive detachment with an enormous tear. Rest is useless in most of these cases because of the large communication between the vitreous and the subretinal space.

Treatment. After rest, diathermy is applied in the region of the tear. Puncture and pressure upon the globe, or air injection; protrusion of a vitreous bead through the puncture is considered of favorable import. Cure, 5 to 30 percent.

FIGURE 12. Multiple tears with an almost total detachment. A very severe type indicating a degenerative condition of the retina or multiple adherences of the vitreous frame to the retina.

Treatment. Extensive diathermy after some days of rest. Puncture. Expulsion of the subretinal fluid. Cure, 5 to 30 percent.

FIGURE 13. Retinal detachment due to superior disinsertion. A rare case and frequently due to traumatism. Little improvement is obtained with rest, a finding common to all cases of disinsertion of the ora serrata.

Treatment. Diathermic application, forming a line limiting the zone of the tear by a barrier of adhesive chorioretinitis. Several diathermal punctures in the diathermized zone. It is convenient to press the globe so that the normal vitreous issues through these punctures. It is impossible to reapply the retina of the tear to its original position. Cure, 40 percent.

FIGURE 14. Extensive detachment with tear at the equator and at the macula. In this case the detachment is initially superior and the tear of the macula appears secondarily.

Treatment. After some days' rest, when maximal reapplication of the retina is attained, diathermy is applied as usual in the region of the superior tear. The external rectus muscle is then sectioned and one diathermic application, or two, is made near the macula and at its outer side for orientation, and light diathermy is applied in the macular zone. Puncture at the level of the superior tear. It is better in this case for the patient to lie in bed on the side of the operated eye thus helping the passage of subretinal fluid from the macular region to the temporal region. Cure, 10 to 35 percent.

FIGURE 15. Total detachment with no visible tears. If the detachment is recent and the whole retina is visible, there are probably no tears, as, unless due to choroidal exudation, with so extensive detachment the tears would be very large. If the detachment is old, there might be small tears especially in the superior hemisphere. If part of the retina is not visible because of folds and prominences of the retina, it is possible that there are hidden tears.

Treatment. Rest and ophthalmoscopic examination to try and see the tears. If these are not visible, we are probably looking at a case of detachment of choroidal origin. In such case, focal sepsis should be excluded or treated with penicillin, pyretogenous cure, or cortisone. If the retinal prominence is not reduced, a puncture can be made to examine the fundus immediately or after a few hours. Cure, 10 to 30 percent.

FIGURE 16. Big tear near the periphery resembling a disinsertion. Severe case, owing to the size of the tear, which favors the rapid extension of the detachment and renders its reapplication difficult with rest.

Treatment. Barrier with flat diathermy and punctures between the tear and the posterior pole of the eye. Cure, 0 to 20 percent.

FIGURE 17. Detachment with tears spontaneously limited. Rarely, a detachment is limited by a line or barrier of chorioretinitis at the edge of the detached portion. The fundus appearance may remain unaltered for years.

Treatment. Hopeful with repeated examination or very light diathermy of the nondetached retina close to the watermark of chorioretinitis. Cure, 95 percent.

FIGURE 18. Very posterior tear with extensive retinal detachment. A rare type which though not associated with large tear is of very bad prognosis.

Treatment. After rest, diathermy and puncture at the zone of the tear, if possible; expulsion of the subretinal fluid and a small amount of vitreous. Cure, 10 to 30 percent.

FIGURE 19. Detachment with tear at the macula. Though the central vision is soon affected, the progress of the detachment is slow owing to the small size of the tear.

Treatment. After rest, section of the external rectus; application of nonpenetrating diathermy, for orientation, near the macula at its external side. After localization of the macular region, further similar diathermy is applied, followed by puncture at the lower part. Cure sometimes requires some months, when subretinal fluid has become more dense. Cure, 50 to 80 percent.

FIGURE 20. Inferior detachment with tear in the medial temporal region. Owing to the tendency of the retinal fluid to descend, especially if the case is some weeks old and the tears are not large, one must look for these in the upper part of the detached zone.

Treatment. Rest, diathermy; if there is subretinal fluid, puncture with evacuation of the fluid by pressure or air injection. Cure, 40 to 90 percent.

FIGURE 21. Inferior detachment with tear in the medial nasal region. Not so grave as the former because the papilla protects the macula.

Treatment. Same characteristics and therapy as for preceding case. Cure, 40 to 90 percent.

FIGURE 22. Large disinsertion of the ora serrata, of almost one third of the anterior insertion of the retina. The prognosis is poor as the communication between vitreous and retroretinal space impedes the application of the choroid to the retina by the reabsorption of the subretinal fluid.

Treatment. Rest for a few days; if there is no improvement, barrier with nonperforating diathermy and perforating diathermy from the 12- to 6-o'clock positions at the site where the retina is closest to the choroid

and where diathermic coagulations can be seen in the retina. Cure, 0 to 20 percent.

FIGURE 23. Recent total detachment with disinsertion of four fifths of the ora serrata. Very rare case of sudden onset. Its rapidity was verified because the fellow eye was blind.

Treatment. Useless. Cure, 0.

FIGURE 24. Retinal detachment in the inferior hemisphere with several tears. This type, as all types of inferior detachment, may remain for a long time in this state, unrevealed to the patient.

Treatment. Rest. If improvement, diathermy in the region of the tears. If not, a diathermic barrier should be produced in the zone where the retina is near the choroid, recognized by seeing that the retina is coagulated by the diathermy. Puncture and evacuation of the fluid by pressure or air injection. Cure, 50 to 80 percent.

FIGURE 25. Inferoexternal detachment with small tear. This may be unrecognized by the patient for a long time, as the detached retina corresponds to the amblyopic zone of the retina hidden by the eyebrow. The tears are very difficult to see if there are hemorrhagic opacities of the vitreous, which naturally tends to settle in the inferior pole of the globe.

Treatment. Same as for preceding case. Cure, 50 to 90 percent.

FIGURE 26. Extensive tear in the inferior equatorial region, resembling a disinsertion of the ora serrata. This type is generally the result of an advanced retinal degeneration or of cystic formations in the retina. It does not improve with rest owing to the large opening between the vitreous and the subretinal space.

Treatment. Diathermic barrier and punctures between the tear and the posterior pole in the zone which is closest to the retina. This is recognized by the coagulation observed when pressing with the electrode when the current is on. Cure, 40 to 60 percent.

FIGURE 27. Disinsertion of the inferoexternal ora serrata. A type peculiar to the infantile and juvenile age periods and sometimes bilateral and symmetrical. It may also be caused by trauma and is of very slow evolution, taking sometimes many months to reach the macular region.

Treatment. Diathermic barrier as for the preceding case. Cures, 80 to 90 percent.

FIGURE 28. Old detachment of the inferior hemisphere with small tears or with no visible tears. In patients who are not good observers or in children, a detachment of this kind may exist for years without the patient consulting an ophthalmologist. Occasionally there are pigmented lines which prove that at previous periods the detachment had reached other limits.

Treatment. If no tears are seen, diathermic barrier, puncture, and evacuation of the subretinal fluid by pressure or air injection. Cure, 30 percent.

FIGURE 29. Large detachment with inferior tear. Such a detachment arouses suspicion of a superior tear (in addition to the inferior one), which may be very difficult to see owing to its small size or because hidden by a fold. A history in which the patient observed a shadow by the side of the nose is confirmatory evidence of this. If the shadow was first observed above it is possible that there is an inferior tear only.

Treatment. Rest and diathermy of the tears with evacuation of the fluid after puncture at the inferior pole. Cures, 10 to 40 percent.

FIGURE 30. Retinal detachment due to albuminuric retinitis. This frequently occurs with the intense retinitis of pregnancy. Tears are usually absent.

Treatment. That of the general condition and termination of the pregnancy if necessary. Cures, 90 percent.

FIGURE 31. Detachment of the retina due to intense scleritis of the anterior pole. There were no tears. The detachment became extended greatly but resolved with subsidence of the scleritis.

Treatment. That of scleritis. Cures, 100 percent.

FIGURE 32. Retinal detachment accompanying detachment of the choroid. In certain cases of choroidal postoperative detachment (cataract, glaucoma) an associated and proximate retinal detachment may occur.

Treatment. Procure the healing of the corneal wound. Cures, 100 percent.

FIGURE 33. Retinal detachment accompanying a choroidal tumor. Transillumination and an exact measurement of the prominence of the retina covering the tumor is the key to the diagnosis, which may be difficult as sometimes the tumor is accompanied by a serous detachment.

Treatment. Coagulation if the tumor is small; if not, enucleation.

FIGURE 34. Retinal detachment accompanying retinal angiomatosis (von Hippel-Lagleyze). Almost all cases of this disease end with a detachment of the retina.

Treatment. In cases not very advanced, diathermy of the angiomas may influence favorably the disease, but once the detachment has appeared, the evolution is fatal.

LOCALIZATION OF SPECIFIC CHOLINESTERASE IN OCULAR TISSUES OF THE CAT*

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In a previous communication,[1] we have described the histochemical localization of cholinesterase in ocular tissues of the rabbit. The histochemical procedure has subsequently been modified to permit differentiation between specific and nonspecific cholinesterases in the cat.[2] In addition, it has been found that artefacts of localization, which occurred with the earlier method as the result of enzymatic diffusion, can be eliminated by incorporating the proper concentrations of sodium sulfate in the incubation media.[3] Accordingly, we have examined ocular tissues of the cat for cholinesterases by the more precise method now available.

MATERIALS AND METHODS

Eyes were removed from cats under sodium pentobarbital anesthesia; as rapidly as possible, the eyes were bisected in the frontal plane, the vitreous and lens removed, and the entire posterior segment or a portion of the anterior segment was frozen on the microtome block.

Sections were cut at 5, 10, and 20 microns. While still in the frozen state they were transferred to slides and allowed to thaw and dry partially[4] before the slides were placed in appropriate storage solutions. Sections of the optic nerve and accompanying short cili-

* From the Department of Pharmacology, College of Physicians and Surgeons, Columbia University, New York, and the Wilmer Ophthalmological Institute, Johns Hopkins University and Hospital, Baltimore, Maryland. This investigation was supported by research grants from the National Institutes of Health, Public Health Service, and the National Cancer Institute of the National Institutes of Health, Public Health Service.

ary nerves were prepared similarly.

Following a minimal period in the storage solutions, the slides were transferred to the incubation solutions for periods of 20 to 90 minutes. The composition of the solutions and details of the procedure have been described previously.[3]

In brief, sections are stained for specific cholinesterase by first inactivating selectively the nonspecific cholinesterase by exposure to 10^{-7}M di-isopropyl fluorophosphate (DFP) in 24-percent sodium sulfate for 30 minutes; they are then incubated with acetylthiocholine and copper glycinate in a medium containing 24-percent sodium sulfate and maleate buffer. Nonspecific cholinesterase activity is demonstrated by incubating sections in a similar medium containing butyrylthiocholine and 28-percent sodium sulfate.

Sections treated first with DFP, then incubated in the latter solution serve as controls. The color is developed by subsequent treatment with ammonium sulfide, which converts to copper sulfide the copper thiocholine deposited at sites of enzymatic activity. Following staining of enzymatic sites, some sections were counterstained with hematoxylin-eosin or methylene blue to facilitate identification of cell types.

Slides were examined by both the ordinary and phase contrast microscopes. The accompanying photomicrographs* were made with uncounterstained sections.

Results and Discussion

Retinal sections stained for nonspecific cholinesterase activity remained blank. Specific cholinesterase activity was represented in the thicker (10 to 20 microns) sections chiefly by two dark bands, one in the innermost region of the inner nuclear layer and one in the inner part of the inner plexiform layer extending into the outer part of the ganglion cell layer (fig. 1).

Between the two, in the outer portion of the inner plexiform layer, was a paler-staining band. Very faint staining was noted in the outer plexiform layer. When thinner (five microns) sections were examined, the outer band was found to consist of cell bodies identified as amacrine cells.

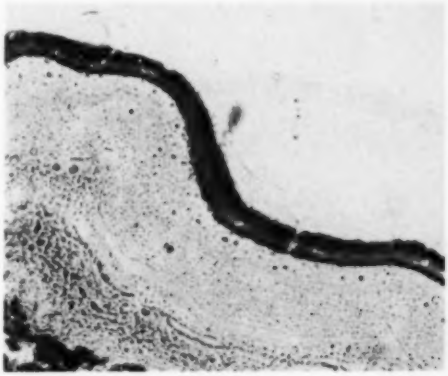

Fig. 1 (Koelle, Friedenwald, Allen, and Wolfand). Retina. Specific cholinesterase, 10 microns, 90 minutes' incubation, low power. (In making this photomicrograph the substage diaphragm was stopped down sufficiently to make some structures in the unstained portion of the retina visible. The heavily stained lower portion of this and the following figure represents uveal pigment.)

The intermediate pale band was composed of their processes, and the inner dark band appeared to represent their numerous ramifications which synapse with the ganglion cells (figs. 2 and 3). Occasional coarsely stained cell processes were seen arising from the stained cells and passing peripherally within the inner nuclear layer.

The foregoing observations confirm in part Anfinsen's[5] conclusion that the cholinesterase activity of the beef retina is located exclusively within the plexiform layers.

Amacrine cells have been stated to be especially numerous in the feline retina.[6] In primates, at least two types have been described: the internal association cells, which apparently convey impulses laterally between groups of ganglion cells, and the centrifugal bipolar cells which are thought to convey impulses peripherally from the ganglion cells to the bipolar or rod and cone cells, and may

* The photomicrographs were taken by Mr. Delbert Parker (figs. 1, 2, 5, and 6) and Mr. Edward R. Hajjar (figs. 3 and 4).

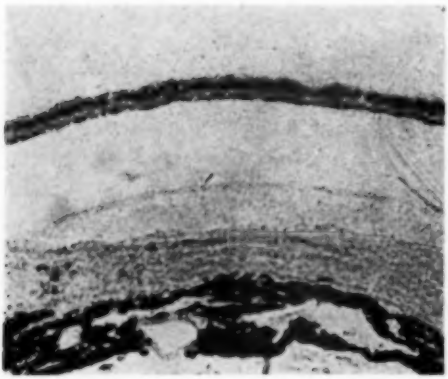

Fig. 2 (Koelle, Friedenwald, Allen, and Wolfand). Retina. Specific cholinesterase, five microns, 20 minutes' incubation, low power.

therefore take part in an intraretinal reflex mechanism.[7] Walls[8] has remarked: "Their exact action and its effects upon subjective visual phenomena are about the biggest remaining mystery in the physiology of the retina."

Sections of the optic nerve showed practically no specific cholinesterase activity in the visual nerve-fiber bundles, but occasional fibers with definite activity were present in the trabeculae between the fiber bundles (fig. 4). We presume that these stainable nerve fibers are autonomic, since the axons

Fig. 3 (Koelle, Friedenwald, Allen, and Wolfand). Retina. Specific cholinesterase, five microns, 40 minutes' incubation, high power.

of the short ciliary nerves were faintly stained.

Such fibers probably constituted the chief source of the low cholinesterase activity found in homogenates of optic nerve by Nachmansohn[9] in contrast to the high values he obtained for retina. Cholinesterase-synthesizing activity was likewise found to be high in the dog's retina and low in the optic nerve by Feldberg and associates.[10]

In autonomic ganglia of the cat, neurons

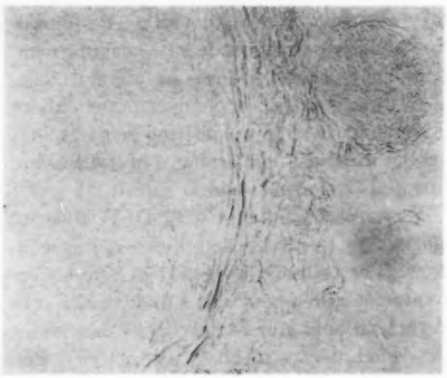

Fig. 4 (Koelle, Friedenwald, Allen, and Wolfand). Portion of the optic nerve (left) and a short ciliary nerve (right). Specific cholinesterase, 10 microns, 60 minutes' incubation, low power.

which give rise to cholinergic fibers contain high concentrations of specific cholinesterase.[3] Thus, if the same situation pertains in the retina, the present findings indicate that the amacrine cells are cholinergic.

In the anterior segment, both the ciliary and iris sphincter-muscle fibers and their associated nerve fibers were deeply stained for specific cholinesterase activity, whereas there was practically no evidence of nonspecific cholinesterase activity (figs. 5 and 6). This is in agreement with de Roetth's analyses of the cholinesterase activities of homogenates of the same tissues.[11]

In contrast, smooth-muscle fibers at other sites examined previously showed a predominance of nonspecific cholinesterase activity.[3]

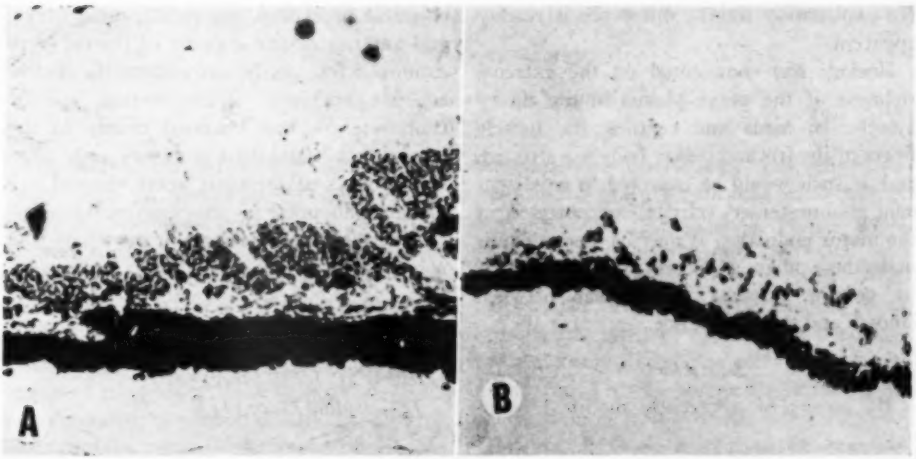

Fig. 5 (Koelle, Friedenwald, Allen, and Wolfand). Iris sphincter, 10 microns, low power. (A) Specific cholinesterase, 60 minutes' incubation. (B) Nonspecific cholinesterase, 60 minutes' incubation. Practically all dark areas in (B) and the equivalent ones in (A) represent uveal pigment.

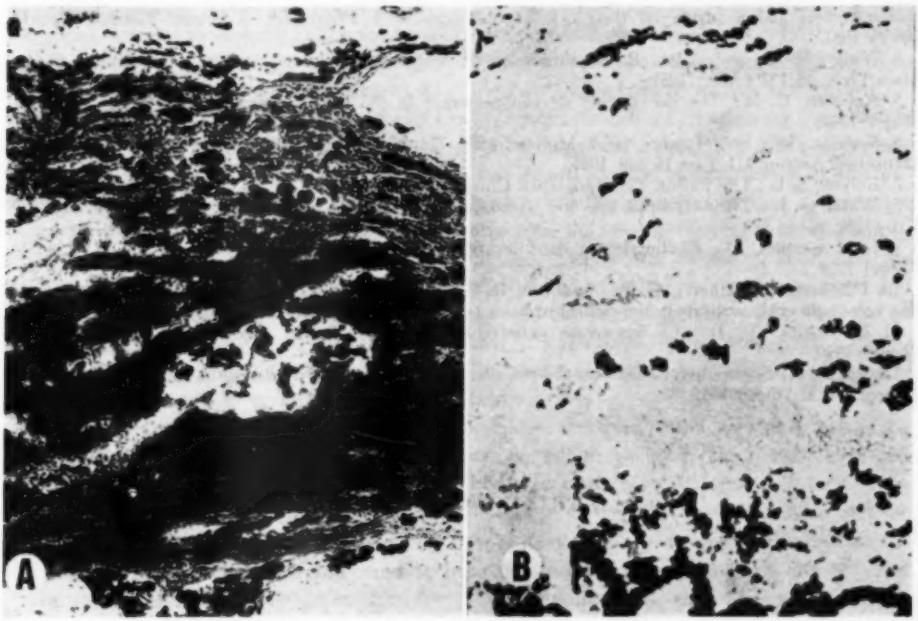

Fig. 6 (Koelle, Friedenwald, Allen, and Wolfand). Ciliary muscle, 10 microns, low power. (A) Specific cholinesterase, 60 minutes' incubation. (B) Nonspecific cholinesterase, 60 minutes' incubation. Practically all dark areas in (B) and the equivalent ones in (A) represent uveal pigment.

No explanation for the difference is readily apparent.

Boeke[12] has commented on the extreme richness of the nerve plexus in the ciliary muscle. In birds and reptiles, the muscle fibers of the iris and ciliary body are striated, and as such would be expected to have specific cholinesterase activity concentrated at the motor endplates. It may be that in mammals these fibers represent a type which is in certain respects transitional between smooth and striated muscle.

Summary

By means of a recently modified histochemical procedure, the retina, optic nerve, and anterior ocular segment of the cat were examined for specific and nonspecific cholinesterase activities. In the retina, specific cholinesterase was confined chiefly to the amacrine cells and their processes; only occasional fibers of the optic nerve showed significant amounts of the enzyme. Specific cholinesterase was present in the ciliary and sphincter muscle fibers and their nerve plexuses. No significant amounts of nonspecific cholinesterase activity were noted in the above tissues.

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Ophthalmic Miniature

Give place to the physician, for the Lord hath created him; let him not go from thee, for thou hast need of him. There is a time when in their hands is good success.

Book of Ecclesiastes,
Compiled by Joshua ben Sirach, 2nd Century, B.C.

EGG MEMBRANE FOR CHEMICAL INJURIES OF THE EYE*

A NEW ADJUVANT TREATMENT

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Detroit, Michigan

The delayed corneal healing that is commonly seen in chemical eye injuries is largely the result of continuous contact with the burned conjunctiva. In an effort to eliminate the injured conjunctiva as a toxic reservoir, a series of cases were treated with the immediate insertion of egg membrane between these two structures. Clinically, this method of treatment proved to be quite effective in preventing corneal destruction and in preserving the normal function and depth of the cul-de-sacs.

Sorsby was of the opinion that the delayed corneal reaction seen in lime burns was secondary to the unhealed conjunctival damage rather than to a delayed effect of the immediate corneal injury. In his book, *Modern Trends in Ophthalmology*, he reported a group of 58 cases, divided as follows: 43 injured by lime, seven by caustics, and eight by miscellaneous agents. He treated these cases by using amniotic membrane grafts and outlined an involved 14-step procedure for preparation of the amnion to be used as a graft.

The results in all of these cases were excellent with the exception of three cases in which the cornea did not clear. Of the entire group, five showed a tendency to symblepharon formations which were quickly suppressed by amniotic-membrane grafting. There is no time follow-up on these cases. Since there is a strong tendency for these types of burns to show recurrences or delayed reactions, the follow-up is an important consideration.

The entire cornea could not be covered by the graft since the amniotic membrane was apparently toxic to the corneal tissues and haziness developed. In those severe cases in which corneal opacification was immediate and deep the graft did not help. However, if there was only superficial damage, a graft produced rapid healing and prevented secondary complications.

Brown, in 1941, after experimenting with several other types of membranes, used fat-free peritoneum from the rabbit as a graft. It was found to be somewhat irritating to the eye tissues. In one of his interesting experiments, he took a portion of severely burned palpebral conjunctiva of the human and placed it over a rabbit's eye. As a result the cornea became cloudy within 24 hours. He surmised that "burned palpebral conjunctiva in constant contact with the corneal surface acts as a corrosive agent." He concluded that a smooth protecting membrane between the two burned surfaces was necessary.

Denig's procedure of excising the necrotic conjunctiva and inserting a graft to replace it is based on the assumption that the unhealed injured conjunctiva has a deterrent effect on the cornea causing delayed complications. Denig was of the opinion that the alkali reacted with the ocular tissues and formed a toxic hydrolysate and, because of this, it was necessary to excise the toxic conjunctiva and replace it with a mucous-membrane graft.

Siegel reported seven cases of burns of the eye in which he used buccal mucous membrane to replace the injured conjunctiva. In six cases, the grafts were successful and the other case resulted in complete destruction of the perilimbal circulation and the eye was destroyed. He felt that, as a result of the caustic alkali burns, a soluble albuminoid was formed in the conjunctiva, the action of which continued for several days. By inserting a graft the nutrition of the cornea and the metabolism was reëstablished, thus preventing the severe secondary complications

* From Department of Ophthalmology, The Grace Hospital.

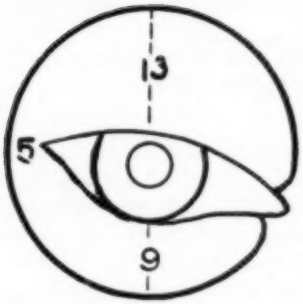

Fig. 1 (Croll and Croll). Dimensions of the conjunctival sac in millimeters with the palpebral aperture open (after Duke-Elder). Compare to surface area of cornea (average: vertical, 10.6 mm.; horizontal, 11.6 mm.).

usually seen with these cases.

O'Connor also advocated immediate grafting in burns of the eye because early epithelization of the conjunctiva was of prime importance. Left to nature the process is a slow one resulting in such sequelae as scarring of the cornea, contractures, adhesions, and functional interference. Grafting should be performed when the patient is first seen since the burned conjunctiva affects the quality and quantity of the nutrition of the cornea.

Denig (1904), Theis (1931), and Schmetzer (1934) all have reported on clinical observation of severe chemical burns in which only the conjunctiva and sclera were involved. The cornea remained clear initially only to develop ulceration and scarring later.

In 1942, Mann and Pullinger reported the results of their work with mustard gas (dichloroethyl sulfide). They concluded that burns in which the limbus was involved resulted in greater damage to the cornea than equal amounts placed on the center of the cornea or the conjunctiva.

Alan Woods made the statement "that degenerative diseases of the cornea can never be understood or treated properly until we have a sound knowledge of the corneal metabolism and changes therein wrought by injury and disease."

There is no one clear-cut concept that embraces the entire scope of pathologic physiology that takes place in the cornea when it is injured by a chemical. In all burns of the eye the cornea is our primary concern since damage to it results in a large degree of visual loss. The conjunctiva per se is apparently of secondary consideration. However, insofar as the conjunctiva, if severely burned, also affects the cornea adversely, it becomes at once of major importance.

The conjunctiva because of its comparatively greater surface area is capable of containing a large amount of destructive chemical. This in turn is held tightly against the cornea because of the induced blepharospasm and in this way maintains the burn over a long period of time. The conjunctival limbal vessels which are the main source of nutrition to the cornea are also seriously affected. Therefore, the chemically altered conjunctiva acts destructively in a twofold manner. Both of these processes go on simultaneously wreaking havoc on the cornea slowly but continuously and over a long period of time.

From a clinical standpoint it would seem, therefore, that the chemically injured conjunctiva is the main factor in causing scarring, ulceration, and vascularization of the cornea.

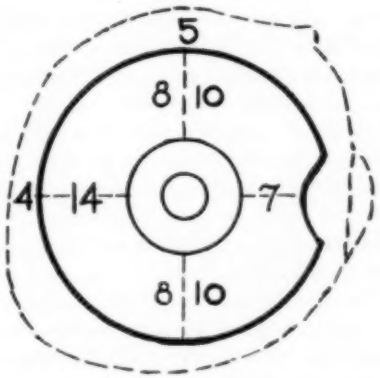

Fig. 2 (Croll and Croll). The distances in millimeters of the conjunctival fornix from the bony orbital margin (outer dotted line) and the corneal limbus (after Duke-Elder).

Insertion of egg membrane between the conjunctiva and cornea serves as a protective cover for the cornea. Egg membrane is a keratin type of protein which is resistant to the digestion of pepsin and trypsin, insoluble in dilute acids, alkalis, water, and organic solvents. On acid hydrolysis it yields histidine, lysine, and arginine.

Among the serious complications that occur in chemical injuries of the eye is the formation of adhesions between the palpebral and bulbar conjunctiva, thus obliterating the cul-de-sacs, partially or entirely. The palpebral conjunctiva can no longer glide smoothly over its bulbar component and motion of the eye is lost, literally resulting in a "frozen eye," depending of course on the extent of the adhesions formed.

The insertion of egg membrane deep into the cul-de-sacs separates the conjunctiva of the globe from that of the lids and permits them to heal without the formation of any adhesions and without loss of cul-de-sac depth.

Chemical injuries to the eyes vary greatly in their mode of action. This is best exemplified by a comparison of acid and alkali burns (table 1).

Acid Burns

Acid burns of the eye are not so severe as alkali burns for several reasons. Acid burns are self-limiting, nonprogressive, and nonpenetrating, and damage to the eyes is an initial damage that can, with few exceptions, be estimated fairly accurately when first seen. Evaluation of a burn is a composite of proper consideration to type of chemical, degree of exposure, physical aspects of the chemical (gas, liquid, or solid), duration of contact, and, lastly, specific toxicity of that particular chemical to the eye.

As a rule only the epithelium, the superficial layers of the stroma, and the conjunctiva that is exposed are involved. These structures are particularly vulnerable because of their immediate accessibility. Initially there is edema of the superficial corneal layers with some opacification. The further penetration of the acid is stopped by the pre-

TABLE 1

Clinical differentiation of acid and alkali injuries

	Acids	Alkalies
Nature	Non progressive; self-limiting	Progressive; not self-limiting
Penetration	Does not penetrate; affects superficial structures (epithelium and anterior portion of stroma)	Rapidly into globe
Epithelium	Albumin is coagulated acting as a barrier	Dissolution of epithelium quickly—no barrier effect
Edema	Slight, transitory	Marked, persistent
Endothelium	Not affected	Damage to the endothelium
Aqueous	Not affected	Quickly altered to plasmoid aqueous saturated with chemical
Amount of Destruction	Can be evaluated when first seen	Can never be evaluated immediately, even if minimal destruction
Sequelae	Few—unless very severe	Many and serious in nature
Scarring	Minimal	Severe, delayed or recurrent
Secondary Infection	Not present	Frequent—unless antibiotics are used early
Prognosis	Good	Guarded; poor
Glaucoma	None	Commonly present
Iritis	None	Moderate to severe
Cataract	None	Present, if severe enough
Ischemic Necrosis	None	Present, if severe injury
Adhesions	None	Commonly present
Obliteration of Cul-de-sac	Never seen	May be present
Conjunctiva	Destruction, slight and superficial	Destruction, severe, through and through
Petechial Hemorrhage	Few	Many present

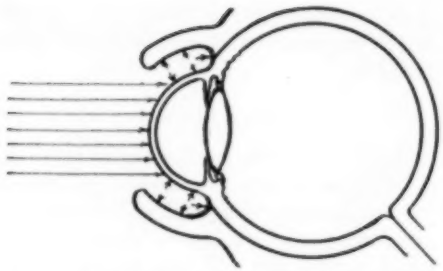

Fig. 3 (Croll and Croll). Acid burn, showing surface destruction of the epithelium and upper layers of stroma and the exposed conjunctiva.

cipitation of the corneal proteins which act as a barrier to the invading chemical.

The aqueous is not affected or altered in its composition so that secondary changes within the globe do not take place. As a result sequelae are few. Secondary infection is not likely to occur because of the superficial damage and early administration of antibiotics. Vascularization, if it does occur, is at a minimum and then only a few superficial vessels may invade the cornea at the limbus.

The prognosis for vision is usually quite good and the opaque cornea will eventually clear with a sloughing of the injured epithelium and its replacement by clear cornea.

The great majority of acid-burn cases which we saw were treated in the office since they were not considered severe. Egg membrane was not used in these cases. This accounts for the small number of acid burns reported herein. In only the very severe cases, in which the chemical had been in contact with the ocular structures for a long period of time, was the egg membrane technique used. All of these cases were treated at the hospital.

Fig. 4 (Croll and Croll). Severe burn with embalming fluid (containing over 10.2-percent phenol), showing opacification of cornea with vascularization, no adhesions, no loss of cul-de-sac.

In one of our cases, embalming fluid containing over 10.2-percent phenol was forcefully and directly driven into the eyes by a hose. The patient was given first aid (tap water for about two minutes) and was in the emergency room at the hospital within 30 minutes. The left eye cleared very well while the patient was in the hospital. The right eye, which received the major portion of the chemical, showed vascularization with involvement of the epithelium, stroma, and endothelium, and eventual loss of industrial vision. Only light perception and projection remained.

Irrigation was performed for 30 minutes but it had little effect since phenol is not soluble in water. This type of acid burn is the exception.

Alkali Burns

Alkali injuries of the eyes are extremely difficult to evaluate when first seen and are treacherous in their mode of action and progress. Alkalis cause burns that are slowly progressive and are not self-limiting. They are extremely destructive and readily penetrate the epithelium, the full thickness of the stroma, and the endothelium into the anterior chamber. The aqueous becomes altered to a destructive medium which exposes to injury all the structures with which it comes in contact—the iris, ciliary body, angle of the eye, lens, and endothelium.

The amount of injury to the endothelium determines the degree of stromal swelling that takes place and the changes that are initiated. Thus, the stroma, which comprises about 90 percent of the cornea, suffers more damage than the rest of the tissue from the initial injury. A "rear-guard" sustaining action from the altered plasmoid aqueous adds to the damage. The endothelium is functionally the door to the stroma.

The iris which has a large surface area (many furrows and crypts) shows signs of

severe marked congestion, wandering of its pigment, and presence of a new type of cells (phagocytes) which are not usually seen in normal iris tissue. A secondary chemical iritis results.

The ciliary body is usually equally and similarly involved. The angle of the eye and its fine anatomic meshwork may become mechanically blocked by the wandering pigment cells of the iris. The drainage of the aqueous at the angle is further endangered by the pushing forward of the swollen iris against the endothelium and the presence of the chemical particles themselves together with their irritating toxic products. A chemical iritis can thus lead to secondary glaucoma.

The anterior layers of the lens are also bathed by the noxious elements of the altered aqueous and, as a result, there may be all stages of opacification depending on the severity and nature of the chemical. Usually there are many fine vacuoles beneath the anterior lens capsule unless the chemical has produced complete damage.

With the destruction (partial devitalization) of the surface tissues and the inner anterior structures of the globe, the conjunctiva becomes an excellent culture media, as do also the structures with which the chemically altered aqueous comes in contact. This permits a new danger to the eye—secondary infection which may hasten further the eventual destruction of the eye.

Ischemic necrosis of the vessels in the limbal region, a serious threat to the eye, is seen in alkali injuries. It is rapid in its rate of onset and materially interferes with the metabolism and nutrition of the cornea.

It is with alkalies that obliteration of the cul-de-sacs occurs wholly or in part, with formation of many adhesions.

Vascularization of the cornea, now opaque, by both superficial and deep vessels through the stroma, comes on later, weeks after the initial injury. It is by nature a slow process and its extent depends largely on the amount of endothelial damage.

Normally the stroma exists in a dehydrated state. Anatomically it is very compact, being made up of parallel lamellae bound together in a compact, very firm manner so that there is no space for any vessel to enter.

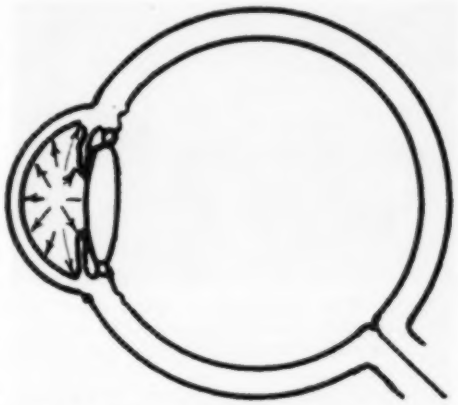

Fig. 5 (Croll and Croll). Alkali burn, showing destruction by the chemical of the anterior chamber, as well as the damage inflicted on endothelium, iris, ciliary body, angle of the eye, and anterior layers of the lens.

Once the endothelium has been injured the lamellar bundles become looser and new spaces are thus created. Into these newly formed spaces, fluid particles appear resulting in edema. This process is followed by the appearance of newly formed vessels extending into these spaces, in the region of the limbal vessels. This accounts for the deep interstitial invasion of the vessels. The superficial infiltration is largely derived from the vessels of the injured conjunctiva. The

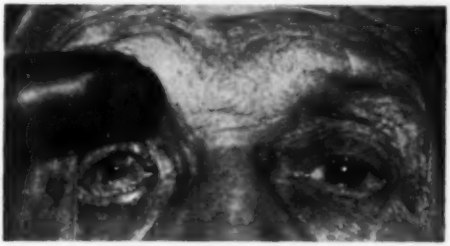

Fig. 6 (Croll and Croll). Alkali burn, severe in the right eye, showing obliteration of the lower cul-de-sac due to many adhesions.

Fig. 7 (Croll and Croll). Ptosis resulting from the many adhesions of the conjunctiva of the upper lid to the globe. Patient is unable to elevate lid.

latter type may be accompanied by some degree of pannus overgrowth onto the cornea or it may extend over onto the cornea as a large, fleshy, pterygialike overgrowth containing several large vessels.

Natural defenses of the eye

The eye contains several mechanisms of defense which act as barriers to check the invading action of a chemical.

Fig. 8 (Croll and Croll). Section of cornea, 42 hours after a lime burn. There is moderate diffuse infiltration of lymphocytes and plasma cells, as well as a small number of fibroblasts, indicating an active repair. Also present are a few scattered polymorphonuclear leukocytes and large monocytes filled with brown pigment.

The first line of defense is the intact epithelium. Because of its comparatively high lipoid content, it does not permit dissociated electrolytes or ions to transverse it. In acid burns, the intact epithelium is particularly effective; in alkali burns, however, its effect as a barrier to the further penetration of the chemical is only of a minor degree. All of us have had the experience of using a chemical to cauterize the cornea, phenol, trichloracetic acid, and so forth. Within 24 hours the cornea is usually transparent again.

It should be clearly kept in mind that so far we have been referring to an intact epithelium. Once the epithelium, whole or in part, becomes injured by chemicals or trauma, that portion which is injured is no longer effective as a barrier and the injurious chemical penetrates readily.

Bowman's membrane has no effective power to resist chemical aggression and, once destroyed, it does not regenerate.

The second line of defense is the stroma which constitutes about 90 percent of the

Fig. 9 (Croll and Croll). Another section from the same cornea.

cornea proper. Its depth is a veritable bulwark and whatever its fate may be is the eventual fate of the entire cornea. By its tissue compactness, formed by parallel bundles bound firmly together, it resists the penetration of the chemical. By this same anatomic peculiarity, it repels the entrance of macrophages and fibrous tissue which are the cause of opacification of the cornea.

The third line of defense consists of Descemet's membrane and the endothelium. Anatomically these structures present a relatively thin barrier to chemical injury. Descemet's membrane is more resistant than its comparable glass membrane and will regenerate if injured.

The defensive qualities of the endothelium, a single layer of cells, are of no significance.

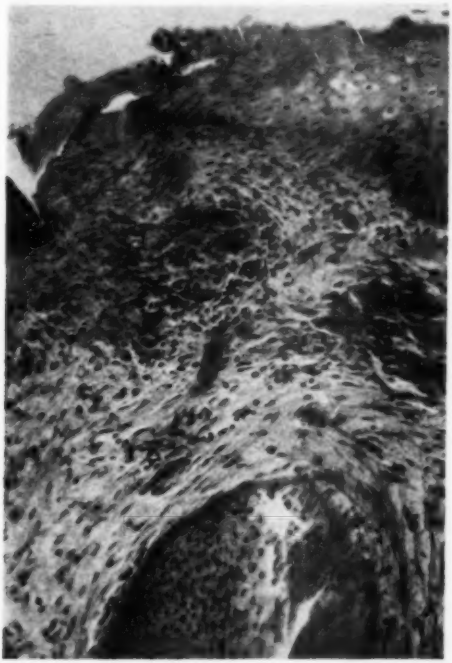

Fig. 10 (Croll and Croll). Mucous-membrane graft to the eye (Denig's procedure) 14 days after injury, showing connective tissue densely infiltrated with plasma cells, large monocytes, and some lymphocytes. This section is in the active stage of repair as indicated by the large number of fibroblasts.

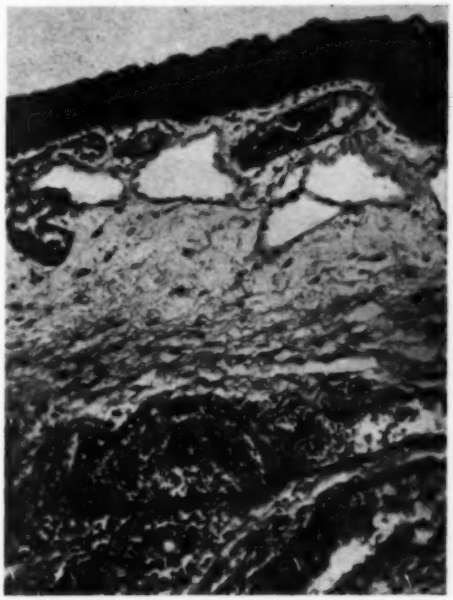

Fig. 11 (Croll and Croll). Section of conjunctiva (42 hours after injury), showing a dense collection of lymphocytes, together with a few plasma cells and fibroblasts. The infiltration is especially abundant about the distended blood vessels. There is already present a superficial edema, one small area of necrosis, and an accumulation of fibrin and lymphocytes.

However, the endothelium is a very important structure and, once injured, the door is opened wide to stromal injury.

In addition to the anatomic defensive barriers of the eye there are several subsidiary mechanisms which contribute some added measure of resistance.

Lacrimation is one of Nature's methods of washing away any harmful fluids. Undoubtedly it is in some measure helpful because tearing dilutes the chemical but at the surface only. Once the chemical has reached the cornea, excessive tearing is probably no longer a defense mechanism. There is no experimental evidence to support the fact that the lysozyme of the tears acts as a defense against chemicals.

The conjunctiva is an extremely thin vascular barrier. It contains several sets of

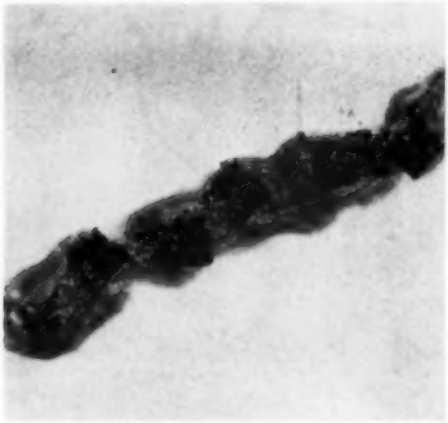

Fig. 12 (Croll and Croll). This is a section of egg membrane before it is used on the eye (control series). There is a meshwork of delicate fibers which take an acid stain. It resembles a mycelium-like membrane.

glands (glands of Henle, Wolfgang, Manz, and Krause) which produce a lubricant between the two conjunctivas, and this small amount of glandular secretion, along with the tears, form a slight barrier between the chemical and the globe. Once the conjunctiva has been injured, these glands can no longer function to their maximum. The blood vessels of the conjunctiva, which are abundantly present, are more active in healing than as defense mechanisms.

Egg membrane in ocular chemical burns

Preliminary treatment

1. *Pontocaine.* Instill 0.5-percent pontocaine in both eyes for relief of pain and blepharospasm. Administer demerol or morphine sulfate intramuscularly to quiet the patient and soothe his anxiety as well as for relief of pain.

Obtain a history as to type of chemical (acid or alkali), exact time of injury, was first aid given, what did it consist of, amount of chemical, duration of exposure, exactly what was the patient doing at time of accident.

2. *Inspection.* A minute inspection of the cornea and conjunctiva is then done, using a magnifying loop and a brilliant source of illumination. The cornea is then stained with two-percent fluorescein to determine exact corneal surface and depth involved by the burn. The amount of conjunctival damage should also be estimated at the same time. Lid margins must be carefully inspected for any breaks in the epithelial surface.

3. *Atropine.* Instill three to four drops of two-percent atropine sulfate, several times, until it is certain that it is beginning to take effect. This must be done early, when the patient is first seen, since iritis appears within 24 hours. More atropine can be instilled later, if necessary.

4. *Chemotherapy, local.* To prevent sec-

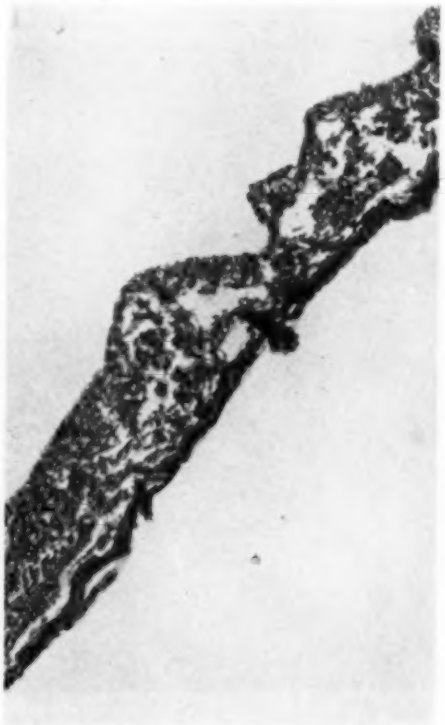

Fig. 13 (Croll and Croll). This section of egg membrane was removed from an eye four days after treatment was begun. Attached to it are a few layers of conjunctival tissue in which there is some fibrous tissue and some polymorphonuclear cells.

ondary infection 30-percent sodium sulfacetamide (three to four drops) should be instilled intermittently into the conjunctival sac. Any pathogens which are present are now in a good culture medium. Their growth must be combatted.

5. *Irrigation.* The cornea is irrigated, slowly with a copious (2,000 cc.) amount of distilled, sterile (room temperature) water, gently from the temporal side.

Then the upper lid is double everted and the injured conjunctiva is searched diligently for any particles of lime (or foreign matter), again using the magnifying loop in conjunction with a good brilliant, yet soft, source of illumination. The search should be very thorough in every fold of the now edematous folds of the conjunctiva. All particles should be picked out gently so that there will be no added trauma.

The conjunctiva is then irrigated gently from the temporal side using 3,000 to 5,000 cc. of water. It should be cautioned that direct irrigation, frontally against the eye, may drive the chemical deeper into the tissues or may loosen up portions of the cornea that are still vital.

Rubber-bulb syringes should not be used for irrigation since they give an uneven flow of water with too much force. The apparatus we use is an intravenous set with a smooth glass tip. The flow of water can be regulated by the height of the container (column of water).

The same procedure is followed in the lower lid.

The cornea is now again irrigated. This is a very important step because some of the conjunctival washings undoubtedly will flow over the cornea and it is possible that they may be a source of toxicity and cause further delayed damage to the cornea. Irrigation should take a minimum of 30 minutes by the clock. If there is any question or doubt, it is much better to take too much rather than too little time.

6. *Preparation of egg membrane.* Two eggs previously boiled for a period of 20 minutes are brought into the operating room in a sterile container. They are removed to a separate table and the eggs are carefully peeled so that at least two large portions of the lining membrane are removed intact. They should measure about 0.75 by 0.75 inches. The rest of the lining membrane is removed in long strips, 1.5 by 0.25 inches, approximately the length of the palpebral fissure.

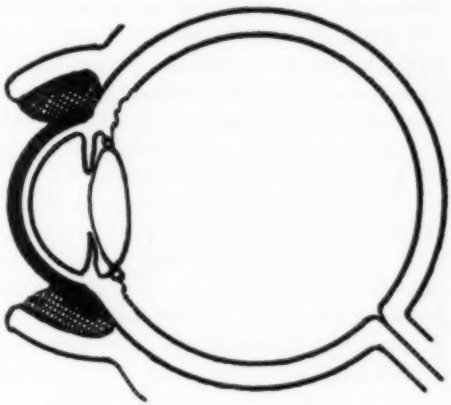

Fig. 14 (Croll and Croll). Drawing to show insertion of double layer of egg membrane to protect the cornea. The cul-de-sac is slightly overstuffed to separate the two opposing healing surfaces.

These pieces of egg membrane are then placed between two pieces of moist gauze to keep them from dehydrating until they are actually used. In the heat of the operating room the egg membrane will have a tendency to dry quickly and become very brittle and difficult to manipulate. The portions of egg membrane that are to be used should be carefully checked for particles of shell.

Operative procedure

For anesthesia, 0.5 percent pontocaine is again instilled. This is necessary because the previous anesthesia has already worn off. At this time more atropine is also instilled, if necessary.

A piece of egg membrane (0.75 by 0.75 inches, square) is now laid over the cornea and sutured superiorly in two places to the

conjunctiva and episcleral tissue with two 4-0, black-silk sutures. The intact egg membrane hangs down over the cornea like a curtain and it is molded securely to conform to the shape of the cornea with the blunt end of a muscle hook. It will adhere very snugly to the cornea and it should overlap the cornea for a distance of three mm. in all directions.

A similar portion of egg membrane is sutured below in two areas and this membrane also acts as a curtain and covers the cornea giving it a double layer of protection. It also is molded to the cornea much as the other portion but directly on top of it.

Next the long strips (1.5 by 0.25 inches) are rolled together in three or four concentric lengths and are firmly packed into the upper cul-de-sac, care being taken not to disturb the sutures and the corneal portions. The patient may evidence a little pain at this junction.

Some difficulty will be encountered in doing this step. The upper lid, because of the induced blepharospasm which is usually marked, will act as a splint and keep the egg membrane in proper position. It is important to overstuff the cul-de-sac slightly so

TABLE 2

RESULTS IN 10 CASES TREATED BY INSERTION OF EGG MEMBRANE

No.	When Seen	Corneal Opacity	Ischemic Necrosis	Iritis	Symblepharon	Cul-de-sac	Vascularization	Morbidity (days)	Vision	Follow-Up
					ALKALI BURNS					
1	14 day	Complete	Marked	Persistent	Almost total	Upper & lower Oblit.	Superficial & deep	36	No L.P. OS =20/20	24
2	4 hr.	0	0	0	0	0	0	4	OD—good (child)	6
4	14 hr.	0	0	Temporary	2 Adhesions	0	0	14	OD =20/30 OS =20/30	41
6	24 hr.	0	Mild partial	Temporary	1 Adhesion	Partial Oblit. of lower	0	12	OD =20/20 OS =20/20	41
7	6 hr.	0	Partial	0	0	0	0	14	OD =20/40 OS =20/20	8
8	13 hr.	¼ of cornea	0	0	0	0	Superficial ¼ of cornea	5	OD =20/20 OS =20/20	12
11	18 hr.	1 disc. area	0	0	0	0	Superficial (receded)	8	OD =20/20 OS =20/20	38
12	48 hr.	Lower ¼ cornea	Mod.	Temporary	0	0	Lower ¼ cornea deep	6	OD =H.M. OS =20/20	9
13	22 hr.	0	0	0	0	0	0	4	OD =20/70	1
14	4 hr.	0	0	0	0	0	0	9	OD =20/20 OS =20/20	14
					MISCELLANEOUS BURNS					
3*	4 hr.	0	0	Temporary	0	0	0	6	OD =20/20 OS =20/20	10
5*	24 hr.	0	0	Temporary	0	0	0	10	OD =20/30 OS =20/30	5
9†	8 hr.	0	0	0	0	0	0	16	OD =20/40 OS =20/40	30
10‡	40 min.	Complete. All of cornea	Marked	Persistent	0	0	Deep & superficial	31	OD =L.P. OS =20/20	42

* Furnace explosion.
† Pressure cooker.
‡ Acid-phenol.

that there is a prompt anterior bulging of the skin of the upper lid. To make doubly sure, the upper lid can be held down by the assistant while the same procedure is performed in the lower cul-de-sac.

The angles both at the inner canthus and outer canthus are also treated in a similar manner. Pieces of egg membrane, approximate in size, are also placed in the angles and only slightly overstuffed. This is necessary or the splinting of the upper and lower lid against the eye would be interfered with.

Pressure dressings are now applied to both eyes.

Postoperative care

The following therapeutic agents should be administered: (1) Penicillin (400,000 S-R units, every eight hours); (2) pyribenzamine (50 mg., every six hours); (3) morphine sulfate (0.25 gr., every four hours for pain); (4) seconal (1.5 gr., at bedtime).

The first dressing is done in 72 hours. At this time the egg membrane in the cul-de-sacs will roll out spontaneously if the blepharospasm has subsided. If not, the egg membrane can easily be picked out. The cul-de-sacs can be inspected for depth of healing and, if necessary, new membrane can be reinserted.

The cornea can be then inspected by gently lifting up the two curtains from below and above; however, the membranes are left in place until the sixth day when the sutures are then removed.

Conclusions

1. An adjuvant treatment of chemical injuries to the eyes is presented with an exact technique for inserting egg membrane to cover the cornea and to separate the injured opposing conjunctival surfaces. The egg membrane is nontoxic to the cornea.

2. A review of the pathologic changes in chemical injuries of the eye is outlined and the sequelae are discussed.

3. Acid and alkali burns are different in their mode of action and the resultant sequelae.

4. Twenty-six cases (10 shown in Table 2) were treated with egg membrane with excellent results. Follow-up of cases varied from one month to 42 months.

5. The procedure is simple and the materials used are readily available.

6. The function of only two eyes was lost. One of these injuries was due to direct involvement with phenol (10.2 percent). The antidote for phenol is alcohol; in the eye, this type of counteraction is not feasible. Phenol is not soluble in water. The other eye, with a severe lime burn, was seen after 14 days.

7. Sequelae, such as corneal scarring, vascularization, ulceration, and recurrent irritability of the eye after long intervals, were reduced to a minimum.

8. Symblepharon was never encountered in cases treated *early* with egg membrane. In the late cases, egg membrane markedly suppressed the formation of adhesions.

1326 Maccabees Building (2).

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CYSTINOSIS WITH CRYSTAL DEPOSITS IN THE CORNEA AND CONJUNCTIVA

Report of a Case

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Cystinosis is a metabolic disorder of young children characterized by deposits of cystine in various tissues. The opthalmologist is called upon to examine the eyes of these children with the slitlamp. If crystals are found in the cornea and conjunctiva, the diagnosis is confirmed. Figure 1 shows the evenly distributed crystals in the cornea and conjunctiva just below the epithelial layer as seen with the high-power corneal microscope and slitlamp.

Cystinosis is the term applied to the particular form of cystine disease which occurs in infants and young children, as distinguished from the disease in older children and adults. The latter form is characterized by the formation of calculi in the lower urinary tract, followed sometimes by secondary renal lesions. Cystinosis is characterized by deposits of cystine in various organs and tissues; only rarely have renal calculi been found in younger children.

Cystinuria is probably the commonest of inborn errors of metabolism and affects males twice as frequently as females. It is an hereditary metabolic error of the sulfur-containing amino acids, methionine and cystine, existing in varying grades of severity. Though cases of different degrees of severity have been described in a single family, the milder forms of cystinuria are inherited as a dominant characteristic, the graver types as mendelian recessives. There is commonly consanguinity of the parents.

The exact metabolic block in cystinuria is a failure in the oxidation of cysteine to a sulfate. The accumulation of unoxidized cysteine causes its precursor cystine to accumulate in the body fluids and spill in the urine. The syndrome consists of stunted growth

(dwarfism), rickets, acidosis, hypophosphatemia, glycosuria.

Clinically, the children appear normal at birth and during the early months of life. In the latter part of the first year or during the second year, growth becomes retarded. The first symptom to appear is severe thirst, followed by polydypsia and polyuria. Children frequently drink to such excess that they vomit. An aversion to solid food develops, leading to chronic anorexia.

Extreme thermolability with poikilothermia and the onset of high fever without apparent cause is present in the disease process. Dehydration and intoxication develop in response to trivial and mild infections.

The bones at first show osteoporotic changes, upon which the changes of infantile rickets, responding to massive doses of vitamin D, may be superimposed. Gradual failure of renal function evolves, to terminate in fatal uremia. With the development of renal failure, the bones show changes of renal rickets. Terminally, there may be elevation of blood pressure, but eyeground changes are usually absent.

Enlargement of the liver but not usually of the spleen is seen in late stages. Stunting of growth may be extreme. There are cystine crystals in the urine, as well as tyrosine and leucine. The specific gravity of urine gets lower as the disease progresses; the urine also shows albumin. Glycosuria is present early. With the development of renal failure, cystine and glucose may disappear from the urine because of faulty renal excretion.

Sternal puncture reveals cystine crystals (Esser[6]). The renal damage in cystine disease has been attributed to the nephrotoxic action of cystine on the glomeruli and tubules.

The number of cases showing crystals in the cornea and conjunctiva could not be determined accurately from the literature. Dent[3] has seen 10 or more cases but unfortunately did not examine the early cases with slitlamp. In his more recent cases the crystals were present in the majority, probably about three fourths. Recently Walsh[9] and others have reported two cases. Both cases showed the crystals in the cornea.

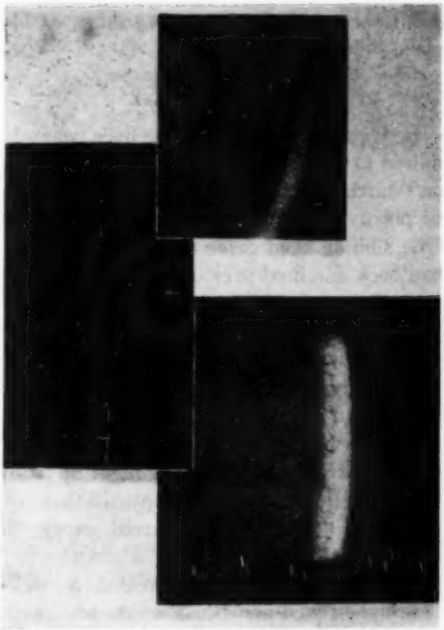

Fig. 1 (Kennedy). Cystine crystals in cornea and conjunctiva as seen with high power of corneal microscope and slitlamp illumination.

Burki[2] in 1941 described the slitlamp appearance in cystinosis and published an illustration. Streiff[7] reported one case with cystine crystals in cornea and bone marrow on sternal puncture. Ullrich[8] also reported one case with an illustration of the cornea.

Bickel[1] has seen 16 cases of cystinosis during the past three years. The age of these children ranged between one and 14 years. In all but two, cystine crystals were found in cornea and conjunctiva as well as in the bone marrow. In the two exceptions the patients were not examined in his hospital and it is possible that the crystals were overlooked because of the difficulty in carrying out a slitlamp examination on a small uncoöperative child. The identification of the crystals was by X-ray crystallography on a

small specimen of conjunctiva taken at biopsy.

Report of a Case

R. D., a 17-month-old white male, was admitted to Babies Hospital in New York City on March 30, 1951, with a chief complaint of polydypsia and polyuria for five months. One sibling, aged three and one-half years, had been admitted previously to the hospital several times because of a renal tubular defect, characterized by polyuria, polydypsia, and albinuria.

Until five months before admission, the patient had always seemed well. Just before admission his minimum fluid intake was 55 oz. daily. He woke during the night up to 10 times for thirst. Urination up to 200 cc. of almost colorless urine occurred every 10 minutes.

Physical examination revealed a well-developed, well-nourished alert boy with prominent costochondral junctions. Liver edge and spleen were palpable. His extremities showed moderate bilateral bowing of shins, prominent distal ends of tibias and fibulas, moderate enlargement at the ends of the radias and ulnas.

He showed a normal blood count. Albumin and sugar appeared in the urine during his hospital stay, varying from one to three plus with occasional acetone and a few white blood cells. Urine concentration test reached a specific gravity of 1.020 after 14 hours of fasting. Blood chemistry studies were essentially normal. Glucose tolerance and renal clearance studies showed a normal glomerular filtration but inability to reabsorb fluid. Sternal puncture showed crystals in the bone marrow.

Eye examination was normal grossly except for a slight diffuse blurred appearance of the cornea of each eye as seen with a hand monocular loupe and focal illumination. Because of inability to hold the child steady at a slitlamp under phenobarbital sedation, a general anesthetic was administered.

With the high power of the corneal microscope and slitlamp illumination, the cornea and conjunctiva of both eyes were examined. They showed an enormous number of finely angular, faintly yellow, sparkling crystals, evenly distributed over the entire surface immediately below the epithelium. No crystals were seen in the deeper layers of either cornea or conjunctiva.

The structure of the crystals could not be made out at this magnification. Their appearance, however, could not be confused with anything else. These fine specks were closely packed, evenly distributed, and, when viewed with a narrow beam, sparkled like tiny rhinestones immediately below the surface of the cornea and conjunctiva, as shown in Figure 1. Other structures in the eye were normal.

On May 28, 1952, R. D. was again examined and no change was noted from the previous examination. On that same day, this patient's brother, E. D., aged five years, was also examined. A previous examination of this boy for crystals in the cornea was negative, but on this date both corneas showed fine needle-shaped crystals in the stroma. Some crystals were also present in the conjunctiva. The fundi were negative.

These examinations were carried out by the eye resident. No mention was made of the location of the crystals in the stroma, whether they were placed superficially or diffusely throughout the stroma.

Unfortunately no biopsy of the conjunctiva of either of these patients was taken.

Comment

A positive finding of crystals in the cornea and conjunctiva in children suspected of having cystinosis is of great diagnostic importance to pediatricians. Ophthalmologists skilled in the use of the slitlamp will be called upon to examine these children.

Summary

1. Cystinosis, an hereditary disorder of cystine metabolism in children, is characterized by deposits of cystine crystals in various organs and tissues.

2. The majority of known cases of this disease have shown crystalline deposits in the cornea and conjunctiva when examined with high magnification and slitlamp illumination.

3. A case is presented with an illustration of the appearance of the cornea and conjunctiva.

129 Clinton St.

I am indebted to Dr. Ruth Harris of Babies Hospital, New York City, for her assistance.

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DRUSEN OF THE OPTIC NERVEHEAD*

Ophthalmoscopic and Histopathologic Study

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Introduction

In January, 1950, we reported[1] a series of nine cases of hyalin tissue or drusen of the optic nervehead, and emphasized the similarity of the ophthalmoscopic picture to papilledema. This clinical entity was first described by Müller[2] in 1859 and, since then, various reports have appeared in the literature. A review of these reports was included in our paper.[1]

Other papers[3, 4] on this subject also stressed the similarity of this condition to papilledema, and pointed out that hyalin tissue in the optic nervehead may cause loss of visual acuity and field.

The outstanding facts are that hyalin tissue may occur in the optic nervehead as either congenital or developmental anomalies, and are believed to be due to a degeneration of excess immature neuroglia. On the other hand, there seems to be evidence that hyalin tissue may also occur as an aftermath or accompaniment of other ocular pathologic conditions.

This hyalin tissue may be either amorphous or formed into solid concretions called drusen. The latter are rounded, lemon-yellow or golden coin-shaped excrescences. Both forms are found either deep in the optic nervehead or may appear superficially on the disc. Whether deep or superficial, the entire disc may appear yellowish-white, blurred, and edematous, and give the appearance of papilledema.

When such drusen are found, one should easily recognize them and realize that the appearance of the disc could very well be due to the hyalin tissue and not to edema from increased intracranial pressure. However, when such solid concretions are too deep to be seen on the disc with the ophthalmoscope, the problem may assume serious proportions.

In such cases, the appearance of the disc may simulate papilledema or optic neuritis to a very marked degree, except that hemorrhages are never present. Furthermore, the blindspots are enlarged and the peripheral fields are often contracted, thus making the clinical resemblance to papilledema even more marked.

* From the Neurosurgical Service of the Beth Israel Hospital.

While in the past the clinical picture of drusen of the optic nervehead, both the superficial and the subsurface variety, was recognized and correctly correlated with the histologic finding of hyalin tissue and drusen formation, there are only two reports in the American literature, each of a single case, in which the authors observed the drusen during the patient's lifetime, and subsequently had an opportunity to examine the histopathologic section of the eyes.

One was by de Schweinitz,[5] in 1891. Unfortunately, fundus photographs were not available then, and no fundus sketches were made, although the author gave an excellent description of the funduscopic picture of the drusen.

The other report was by Goldstein and Givner[6] in 1933. They reported a case of chronic glomerulonephritis with uremia, showing hemorrhages and bone corpuscular pigment in the retinas, besides the drusen in the optic nervehead. Their report includes a sketch of the fundus showing the drusen, as well as histologic sections.

In all the other cases reported in this country, the clinical picture of the optic-nerve drusen was drawn from one series of cases, and the histologic sections were from examinations with no record of clinical ophthalmoscopic findings during the same patients' lifetime.

Reports on the clinical picture, as well as pathologic sections, were made by Reese[7] and Samuels.[8] The latter reported on the histologic examination of 20 globes in which optic-nerve drusen were found. However, in none of these cases were there any adequate descriptions of the drusen in the fundi during the patient's lifetime.

In the case we are reporting, we were fortunate enough to observe the patient's fundi during his lifetime, and to obtain fundus photographs in color. The patient died within one month after this observation was made, and sections showing the nerveheads were obtained.

Case report

The patient was a 40-year-old white man who was in excellent health until the winter of 1948. At that time, he noticed a "run-down feeling" and a mild ache in the right supraclavicular region. Hospitalization and examination revealed evidence of a lung tumor of the right apex. On November 1, 1950, he was admitted to the Neurosurgical Service of Beth Israel Hospital for the relief of intractable pain.

Physical examination revealed a chronically ill-looking man, who presented a Horner's syndrome on the right side. There was evidence of generalized pulmonary osteoarthropathy. In addition to the Horner's syndrome, there were neurologic signs related to brachial plexus interference on the right but no neurologic signs indicative of any intracranial metastases.

Ocular examination. Vision in the right eye was 20/100, and poorly correctible to

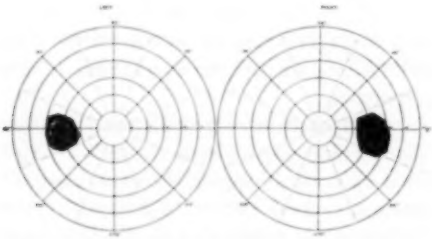

Fig. 1 (Chamlin and Davidoff). Blindspots for 3/2,000 white.

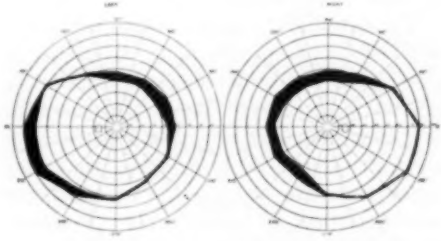

Fig. 2 (Chamlin and Davidoff). Peripheral fields for 2/250 white.

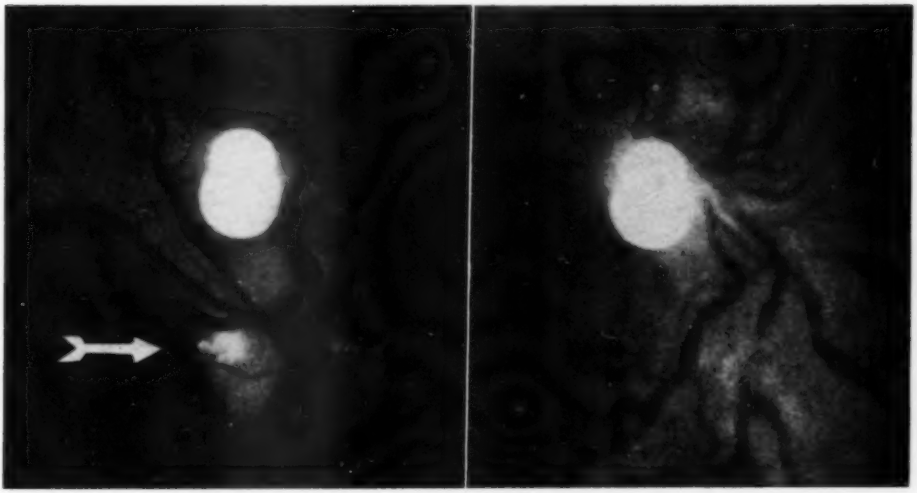

Fig. 3 (Chamlin and Davidoff). (Left) Left fundus showing glistening drusen on nasal margin. Arrow points to drusen. (Right) Right fundus showing blurring of the disc and all margins by amorphous tissue.

20/70 with a +2.0D. sphere. Vision in the left eye was 20/30, and no correction was accepted. External examination revealed a Horner's syndrome on the right side. Extraocular motility was unrestricted, and the media were clear.

In the right fundus, the disc margins were quite blurred, and the disc appeared to be somewhat swollen. There was no cupping, and the veins were full and tortuous. No hemorrhages were noted.

In the left fundus, the temporal margins were made out, but the rest of the disc was also blurred, as in the right eye. In addition, on the nasal side, two or three tiny yellow excrescences were seen to protrude from the generalized haze, and these were interpreted to be small drusen or discrete hyalin bodies. In view of these, we concluded that the total eyeground picture was produced by drusen in the optic nerveheads.

The blindspots were mapped out with 3/2,000 white, and found to be enlarged (fig. 1). The blindspot of the left eye measured 9.5 by 10.5 degrees, and the blindspot of the right eye, 8.75 by 12.5 degrees. The peripheral fields for 2/250 white showed only some questionable constriction in the periphery (fig. 2).

Detailed central fields could not be plotted due to the patient's poor physical condition. This was particularly unfortunate in view of the fact that vision was so poor in the right eye, and a central field study might have given some indication as to whether or not the drusen could have accounted for the loss of central vision. Fundus photographs were made in color, and these are reproduced in black and white (fig. 3).

Following a chordotomy procedure, the patient obtained considerable relief for about two weeks, when pain began to return, and he died about one month after the fundus photographs were obtained.

A postmortem examination revealed that the patient had been suffering from a bronchogenic carcinoma of the right lung. Examination of the head revealed that there was no evidence of any increased intracranial pressure, and the gross examination of the brain showed no abnormalities. Both globes were removed and sectioned. Typical histo-

logic sections of the optic nerveheads are shown in Figure 4.

Microscopic examination of the globes revealed some peripheral cystic degeneration of the retina. Nasally, in both eyes, there was loss of some of the anterior wall of the cystic retina. In the region of the discs, there was considerable elevation of the nerveheads, together with the formation of a so-called neuritic roll (N in fig. 4—lower view) dis-

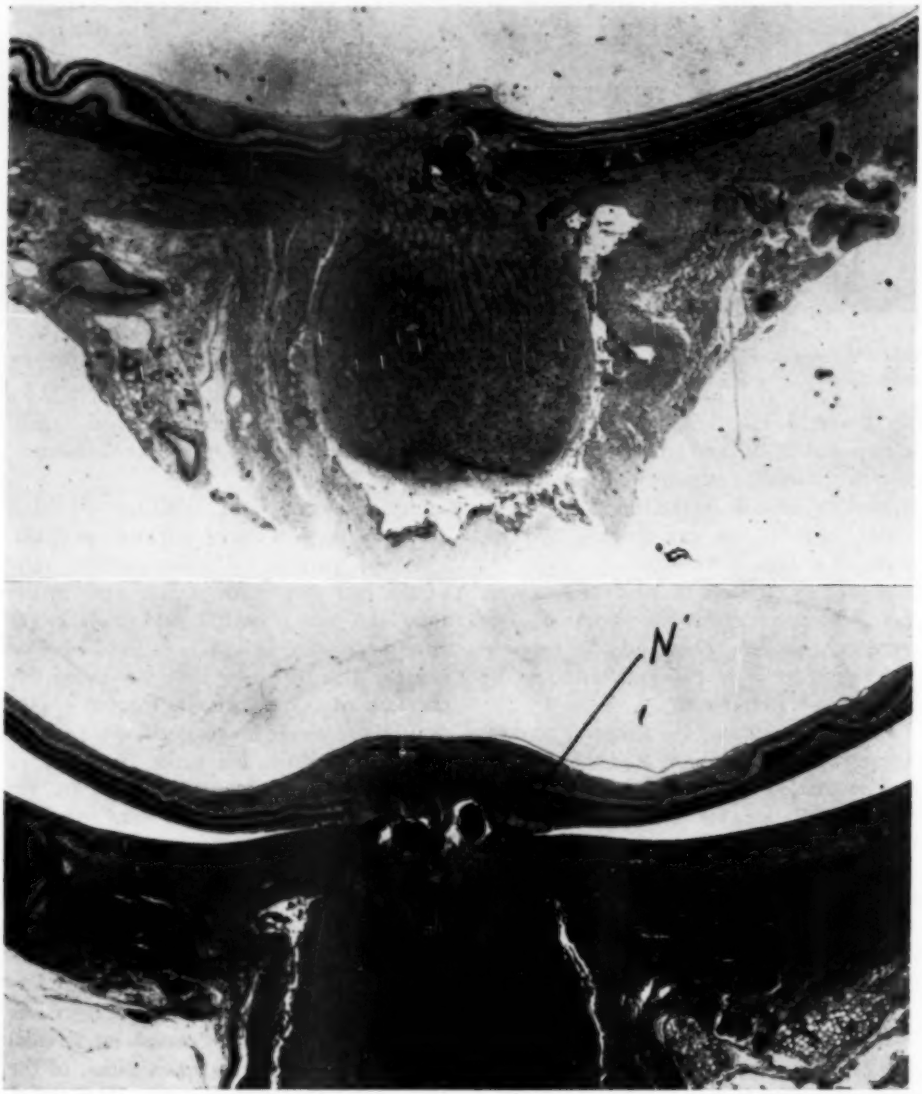

Fig. 4 (Chamlin and Davidoff). (Above) Histopathologic section through left globe showing hyalin bodies between lamina cribrosa and anterior surface of disc. (Below) Histopathologic section through right globe showing drusen occupying a large area of the optic nerve as it lies in the choroidal canal.

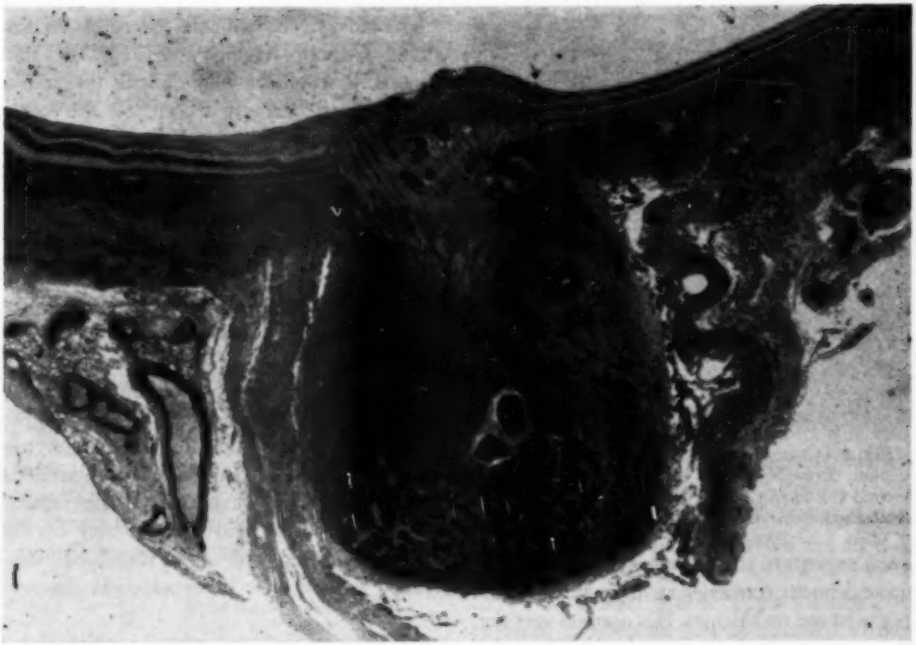

Fig. 5 (Chamlin and Davidoff). Myelin sheath of left globe. Stain shows atrophy of nerve fibers nasally.

placing the retinal percipient elements on either side and thus accounting for the enlarged blindspots.

This phenomenon simulates the histologic picture of papilledema as described by Samuels,[9] except that the sclera in the region of the lamina cribrosa is not bowed forward as in papilledema due to increased intracranial pressure. Rather, it follows the regular contour of the posterior sclera, or it is even bowed a little further back, due to the space-occupying drusen and the reactive swelling in the nerve fibers. Between the lamina cribrosa and the anterior border of the disc, both globes showed the so-called drusen.

In the left eye, where the drusen were visible ophthalmoscopically, they seemed to be more anterior, some small ones pushing directly against the retinal percipient elements on the nasal side. In the right eye, they were deeper and more centrally located, the percipient elements being pushed to either side by a so-called neuritic roll, much as in papilledema due to increased intracranial pressure.

The deposits consisted of small discrete bodies of smooth, noncellular substance lying between the lamina cribrosa and the anterior surface of the optic disc.

In the left eye, there was a single large deposit with several smaller satellites, more deeply and centrally located than in the left eye. The structure of these bodies was that of a smooth, lamellar type of concretion, looking much like the concentric layers of a glass marble split open, and staining a purplish color with hematoxylin and eosin. Nasally, in the left eye, there was some atrophy of the optic nerve fibers. This is seen in the myelin sheath stain (fig. 5).

Several slides were sent to Dr. Harry Zimmerman, director of Pathological Laboratories at the Montefiore Hospital, who was

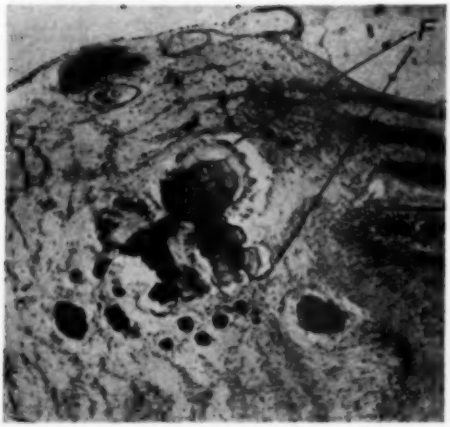

Fig. 6 (Chamlin and Davidoff). Enlargement of section through drusen in left globe. The rim around the hyalin bodies labelled "F" gave a positive reaction for iron pigment.

good enough to study them. He reported that these deposits contained an abundance of iron pigment but no calcium. His opinion was that they represented "a complex protein-rich inspissated fluid containing a considerable quantity of iron." He believed that the lesion is very much like that found in degenerative changes in the brain and that the etiology for such changes is not known.

Discussion

In previous reports, the following observations were made: Hirschberg and Cirincione concluded that these concretions are hyalin masses that may become calcified secondarily. In 1922, Tobler[10] concluded that they were a split product of albumin, very near to being hyalin, which has a tendency to take up calcium. Goldstein and Givner,[6] in 1933, found a positive reaction to Von Kossa's stain for calcium.

Goldstein and Givner's case showed discs that were quite typical of hyalin tissue, on the disc as well as buried within the optic nerveheads. The usual enlargement of the blindspots, as well as a mild peripheral contraction of field, was found. These findings were typical of those found in our[1] series of nine cases reported in January, 1950.

If one were to evaluate the right fundus alone, without having access to the left fundus, it would be very difficult to make a diagnosis of buried drusen of the optic nervehead because no discrete bodies were found on the surface. One might have strongly suspected papilledema due to increased intracranial pressure.

In this case, particularly, the presence of a malignant tumor of the lung made one highly suspicious of increased intracranial pressure due to possible cerebral metastases. However, the few small glistening bodies found on the left disc head were enough to prove that we were dealing with hyalin tissue of the nerveheads, thus accounting for the blurring on both sides. The pathologic sections showed the very typical drusen bodies in both optic nerveheads, and examination of the brain showed no evidence of increased intracranial pressure or other cerebral involvement.

From these findings, several problems present themselves. In the first place, are all so-called drusen of a similar nature? We do know that some of them become calcified. Furthermore, are those found in children the same as those found in older people? Are those found after intraocular disease the same as those occurring without any preceding intraocular disease? Is the presence of these bodies in the optic discs indicative of any co-existent bodies in the brain?

A large number of cases has been reported with retinitis pigmentosa, lesser numbers with syphilitic choroiditis, glaucoma, and albuminuric retinitis. One of the cases reported in our[1] previous study subsequently turned out to have epileptiform seizures. Reese[7] even suspected that drusen are "formes frustes" of tuberous sclerosis. Certainly the clinical pictures accompanying the various reports are widely diversified and range from intracranial and ocular disease to symptomless cases in which the drusen are found on routine ocular examination.

Dr. Zimmerman's interpretation of these bodies as a degenerative process must prompt

us to look for other evidence of central nervous system disease in these cases, with the hope of finding a common factor. On the other hand, perhaps not all drusen have the same histologic and chemical structures as are described in this case; thus they may be either congenital or developmental, without signifying any disease.

All these problems should spur us on to more exhaustive clinical investigation and follow-up study of patients presenting drusen of the optic nerveheads, and every attempt should be made to obtain the eyes for histologic examination when the opportunity presents itself.

In our present ignorance of the answers to those questions, we can only continue to make use of all our diagnostic abilities to recognize the disease entity and to differentiate it from papilledema.

Summary

1. A case is presented in which clinical evidence of drusen of the optic nervehead was found. Fundus pictures and histologic sections of these eyes are shown.

2. As in papilledema, a neuritic roll may be present. This edematous tissue may well be due to the presence of the drusen; both together may account for the encroachment on the percipient elements with the resultant enlargement of the blindspots.

3. In papilledema due to increased intracranial pressure, the lamina cribrosa are bowed forward, while in drusen, they are bowed backward. This is easily understandable from a mechanical point of view since the pressure is exerted by the space-occupying drusen and edema anterior to the lamina cribrosa, whereas, in papilledema, the pressure comes from behind the lamina cribrosa, pushing the lamina forward.

4. Evidence is presented that these deposits are composed of a protein-rich fluid containing iron and resemble the lesions found in degenerative diseases of the brain. While some cases of drusen may represent only a developmental anomaly, it seems possible that, in other cases, they may represent a degenerative process, possibly with a similar process going on in the brain. Therefore, more intensive clinical and pathologic investigation should be carried out in these cases whenever possible.

5. Until such a time when a more exact clinical significance can be attached to these drusen of the optic nervehead, our responsibility is to recognize them clinically and differentiate them from papilledema due to increased intracranial pressure, with which they may easily be confused.

815 Park Avenue (21).

We are indebted to Dr. Samuel Gartner, director of the Opthalmological Service of the Montefiore Hospital, for his aid in the interpretation of the histopathologic findings, and to Miss Hilda Bergen, who prepared these slides.

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INCLUSION-BLENNORRHEA VIRUS*

Phase-microscope studies

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Phase-contrast microscopy has been employed by many workers for identification of viral lesions. Angulo, Richards, and Roque (1949) were able to demonstrate the characteristic intranuclear Torres inclusion bodies and Councilman lesions found in monkey liver tissue, infected with yellow-fever virus. Likewise, Lipschutz bodies were recognized within the nuclei of liver cells derived from a fatal case of generalized herpes-simplex infection affecting a nine-day-old child.

The Bollinger intracytoplasmic inclusions of fowl pox were shown to appear as refractile masses of granular structure contrasting with the almost transparent, dark background of the remaining cytoplasm. Similar appearances were presented by the typical cytoplasmic Lentz bodies of mink distemper, found in sections of bladder.

Angulo and others conclude that a distinct difference exists between the image of a normal nucleus and that of an inclusion-bearing one in fixed tissue sections. Whereas, in the normal nucleus the only structures visible with bright-phase contrast were the nuclear membrane and nucleolus, those containing inclusions revealed a refractile mass surrounded by a dark area.

Frequently, infected nuclei also showed absence of the normal refractile nucleolus. Cytoplasmic inclusions were identified similarly.

Phase-contrast illumination has proved helpful for the study of inclusion bodies of psittacosis and vaccinia and Barer (1948) found that the high resolving power obtainable with the phase-contrast method at a magnification of ×1,600 enabled such inclusions to be viewed with considerable advantage. Barer (1948) also suggested that visibility may be enhanced by employment of stronger absorbing phase plates used in conjunction with more intense sources of light.

In the present paper, good resolution was obtained up to magnification of ×3,200.

Optical equipment

The source of illumination consisted of a 12-volt, high-intensity coiled filament lamp with condenser and iris diaphragm. For visual inspection a light-blue ground-glass filter was employed. For photography two clear optically flat-glass filters, the one light blue-green and the other light orange, were used in combination.

Microscopic components consisted of a Spencer instrument fitted with a phase-contrast substage condenser of NA 1.25; oil immersion 1.8-mm. achromatic objective of NA 1.25 having an initial magnification of ×95 fitted with a 0.14A-O.25λ phase-diffraction plate.

Photographs were taken with a ×8 eyepiece and Zeiss eyepiece camera at a magnification of ×800. Negatives were obtained in Ilford rapid process panchromatic plates and enlarged ×3 to ×4. The final magnification of each illustration is as follows:

Figures 1 and 2, ×2,400; Figures 3, 4, and 5, ×3,200; Figures 6 and 7, ×2,400; and Figure 8, ×3,200.

Materials and Technique

Smears of conjunctival scrapings selected from three separate cases of inclusion blennorrhea contracted in Toronto and a fourth stained slide provided by courtesy of Dr. Phillips Thygeson of San Jose, California,

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were subjected to phase-contrast examination.

Slides were stained with a 1:10 dilution of Gurrs R66, Giemsa solution, made up in the phosphate buffer of pH 7.0, for 60 minutes. Excess dye was removed by rapid immersion in absolute alcohol followed by washing with distilled water and drying in air. All smears were sealed with a coverslip in Canada balsam cement prior to examination.

Specimens of electron-microscopic examination were prepared after the usual manner by placing infected eye material on formvar mounts, drying in air, and light shadowcasting with chromium metal.

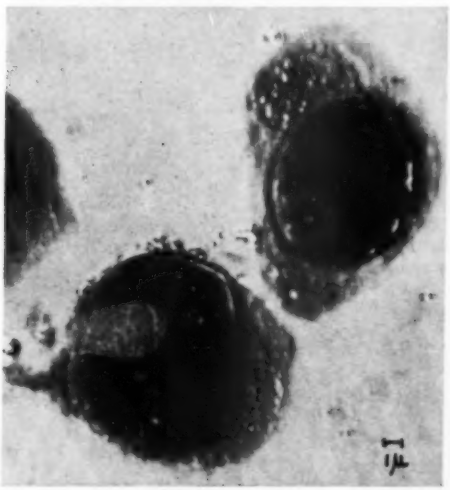

Fig. 1 (van Rooyen, Ormsby, Thomson, and Beattie). A small intracytoplasmic inclusion body (×2,400).

Results

Figures 1 to 8 inclusive were photographed with phase-contrast equipment. Figure 1 shows a small intracytoplasmic inclusion body (5 to 7μ) presumably in an early stage of formation.

Figure 2 illustrates another inclusion body of larger size (7 to 12.5μ) at a later period of development, and composed of smaller internal masses ranging in size from

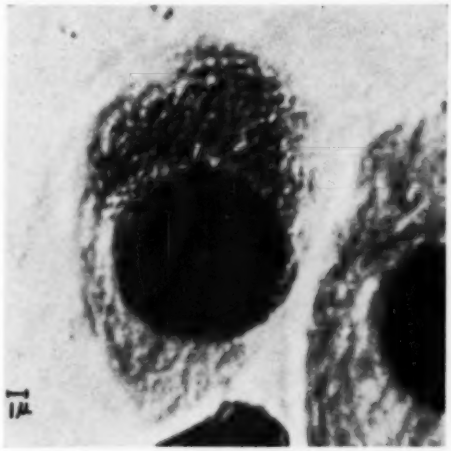

Fig. 2 (van Rooyen, Ormsby, Thomson, and Beattie). An inclusion body of larger size (×2,400).

200 to 600 mμ. The inclusion material is closely adherent to the nuclear membrane of the cell.

Figures 3, 4, and 5 show mature inclusion bodies both single and multiple, the largest of which (fig. 4) fills the entire cytoplasm of the cell causing lateral displacement of the nucleus.

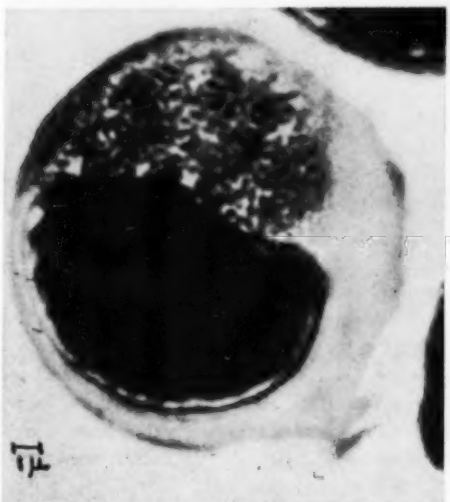

Fig. 3 (van Rooyen, Ormsby, Thomson, and Beattie). Mature inclusion body (×3,200).

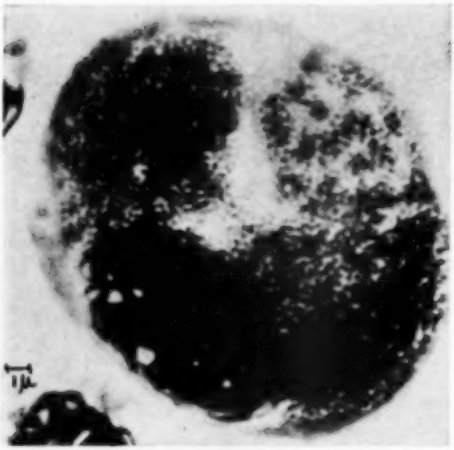

Fig. 4 (van Rooyen, Ormsby, Thomson, and Beattie). Mature inclusion body filling entire cytoplasm of the cell, causing lateral displacement of the nucleus (×3,200).

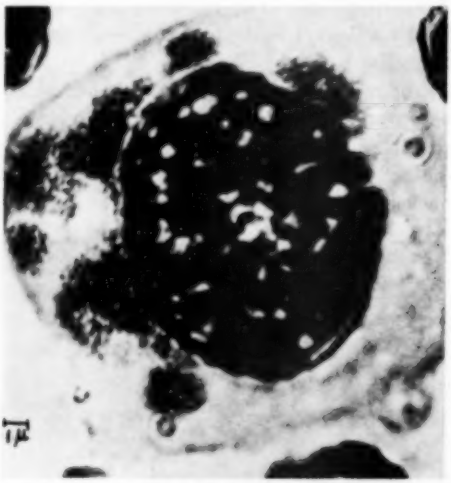

Fig. 5 (van Rooyen, Ormsby, Thomson, and Beattie). Mature inclusion body (×3,200).

In Figure 6, the inclusion body is composed of fully developed elementary bodies and appears to be partially detached from the cell nucleus. In Figure 7 the mature inclusion body is lying free within the cytoplasm of the infected cell.

To enable comparisons to be drawn between the elementary bodies of inclusion blennorrhea and those of another virus disease, Figure 8 reveals the appearance of the elementary bodies of molluscum contagiosum as photographed with the same phase-contrast equipment magnified ×3,200.

Efforts to obtain satisfactory electron-

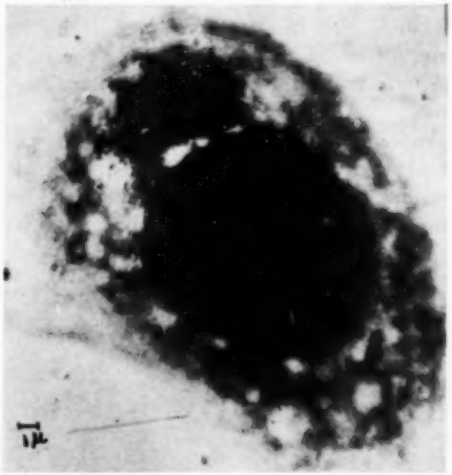

Fig. 6 (van Rooyen, Ormsby, Thomson, and Beattie). The inclusion body is composed of fully developed elementary bodies and appears to be partially detached from the cell nucleus (×2,400).

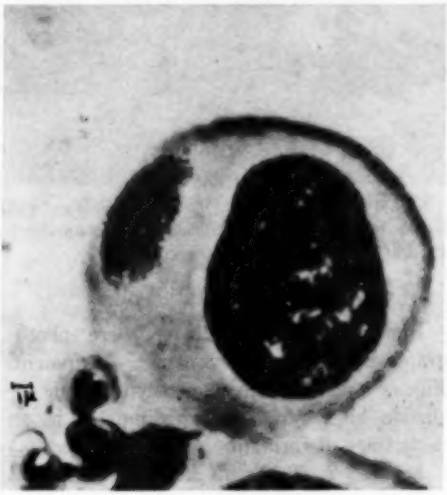

Fig. 7 (van Rooyen, Ormsby, Thomson, and Beattie). Mature inclusion body lying free within the cytoplasm of the infected cell (×2,400).

microscope photographs of inclusion blennorrhea from virus preparations of conjunctival scrapings proved difficult. Figure 9 shows the surface appearance of an inclusion body ×7,760.

Free elementary bodies magnified ×16,400 are depicted in Figure 10. Size measurements obtained from electron microscopy support the findings as observed by phase-contrast microscopy.

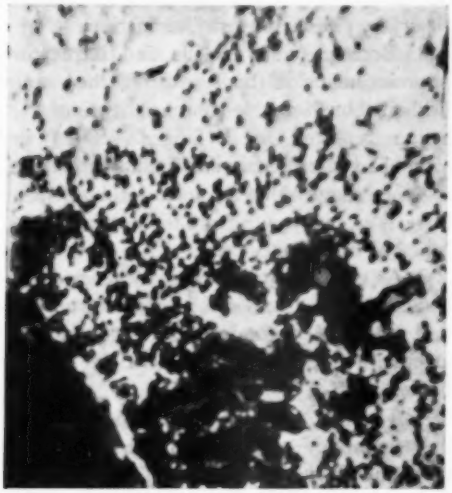

Fig. 8 (van Rooyen, Ormsby, Thomson, and Beattie). Elementary bodies of molluscum contagiosum (×3,200).

Discussion

The earlier observations of Thygeson and Mengert (1936), with the light microscope, failed to detect the presence of any stainable matrix within the inclusion cavity. These same workers also drew attention to the tendency of extracellular free elementary bodies to undergo clumping due to the presence of an adhesive fluid within the inclusion body. Presumably it is the latter which has made it so hard to secure clear electron-microscope photographs of single elementary bodies.

Our present observations with phase and electron microscopy support the conclusions of Thygeson and Mengert (1936). We likewise have been unable to demonstrate a stainable matrix. The characteristics of inclusion-blennorrhea virus inclusion bodies seem to be different from those of molluscum contagiosum which has been extensively

Fig. 9 (van Rooyen, Ormsby, Thomson, and Beattie). Surface appearance of an inclusion body (×7,760).

Fig. 10 (van Rooyen, Ormsby, Thomson, and Beattie). Free elementary bodies (×16,400).

studied by Banfield, Bunting, Strauss, and Melnick (1951), Rake and Blank (1950), and van Rooyen (1938, 1939).

The inclusion body of molluscum contagiosum is a well-defined encapsulated structure and, according to Banfield and others (1951), the mature molluscum-contagiosum inclusion bodies are divided into locules by septa. Individual locules contain mature inclusion elementary bodies which appear to arise from the material composing the matrix of the septa by a process of regimentation and condensation.

Since the deductions of Banfield and others (1951) were derived from a study of histologic sections thin enough for electron microscopy, accurate comparisons with our findings are not possible. Our methods have not permitted examination of the internal structure of the inclusion blennorrhea inclusions.

In the interpretation of appearances seen by phase microscopy it is important to bear in mind the cytologic studies of Zollinger (1948) respecting alterations in the nuclei of resting and dividing cells induced by fixations and anisotonic solutions of acids and alkalis. Thus cells exposed to formalin, acids, alcohol, and acetone showed a brilliant type of nucleus.

Such nuclei are irreversibly shrunken and their nuclear membrane and chromatin network appear brilliant bluish in color exhibiting a double contoured outline.

Since the microscopic smears we have examined were fixed with alcohol and stained with Giemsa solution, it is interesting to note that the inclusion and elementary bodies of inclusion blennorrhea are identical in appearance with the brilliant bluish double contoured appearance of cell nuclei fixed with alcohol (Zollinger, 1948).

Conclusion

1. The inclusion and elementary bodies of inclusion blennorrhea virus have been demonstrated and photographed with great clarity by phase-contrast illumination.

2. Both the cell nucleus and intracytoplasmic inclusion body exhibit the same brilliant bluish double-contoured type of reaction reported by Zollinger (1948) in alcohol-fixed cells. Similarity and proximity together suggest that the inclusion body may arise as an outgrowth from the nuclear membrane of the infected cell.

3. As growth proceeds, the inclusion body detaches itself from the nuclear membrane and gradually undergoes segmentation eventually to constitute a mass of elementary bodies.

4. There is no evidence to show that the inclusion body of inclusion blennorrhea is surrounded by an enveloping membrane.

Connaught Medical Research Laboratories (4).

Acknowledgments

We are indebted to the Snyder Foundation for Ophthalmic Research, New York, for their generous support of this study. Our thanks are also due to Prof. A. J. Elliot for access to clinical material. Electron-microscope photographs were obtained at the Department of Physics, University of Toronto.

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BILATERAL RETINOBLASTOMAS IN SIX SIBLINGS

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From time to time familial retinoblastomas have been reported, along with case histories and reviews of accumulating data. Herewith is presented the case histories of six bilateral affections in a sibship of nine. It is believed that this series is of value since several interesting features warrant its presentation.

In this family 66 percent of the members are affected, the bilateral incidence being 100 percent. Frequency of bilateral incidence has been reported as between 20 to 30 percent (Duke-Elder[1]) and over 50 percent (Reese[2]). Newton[3] recorded seven bilateral retinoblastomas among the 10 persons affected in one family. Since the extremely virile and equally ignorant parents of the group herewith reported are still able to have more children, a record may be established in spite of all efforts that have been made to prevent this occurrence.

The parents of the six affected siblings are poor, white, share-crop farmers. The mother, whose left eye is microphthalmic and who will not permit its examination, states that, when she was a young child, she got coal dust in her eye which made her blind. The grandmother was informed at that time that her child has "cancer" of the eye. If this is true, the "cancer" has retrogressed, as is possible, and occasionally reoccurs.[4] This retrogression took place in one of the siblings and will be described and demonstrated later. The father's eyes are apparently normal.

The hereditary factor cannot be investigated further as the incoöperative and belligerent father denies an opportunity with threats supported by a shotgun. The difficulties encountered can be illustrated by the fact that four of the six affected children were brought into the hospital on court orders.

Figure 1 diagrams the sibship; the case reports follow.

CASE REPORTS

The first child, a boy, allegedly was blind in the right eye from birth. He was admitted

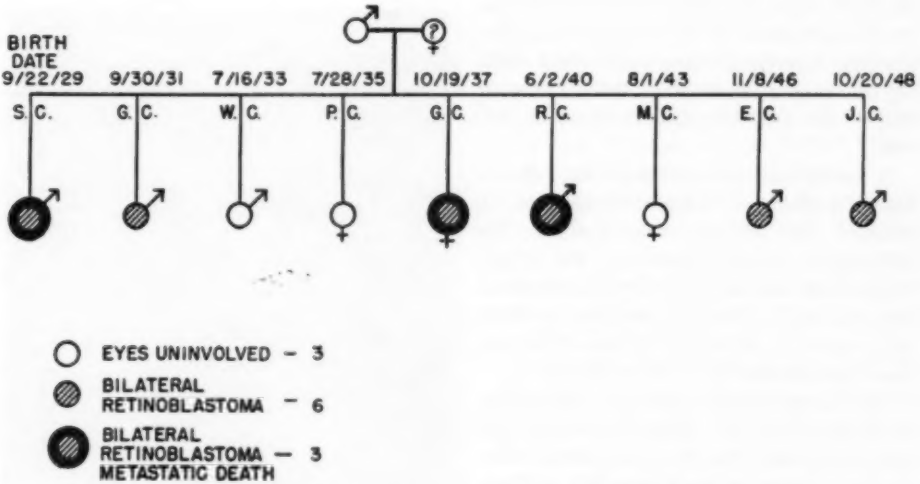

Fig. 1 (Sovik). Pedigree of family showing six cases of bilateral retinoblastoma.

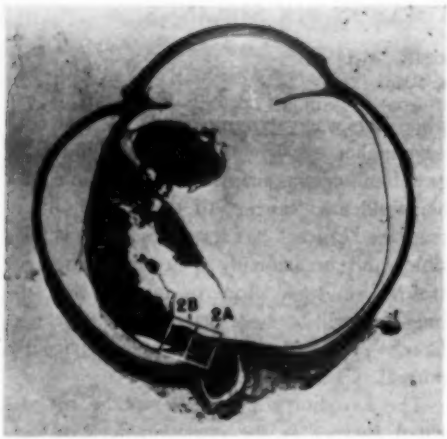

Fig. 2 (Sovik). Gross appearance of section of left eye of second child.

to the Cincinnati Children's Hospital at 32 months of age with proptosis of the right eye which had been present for "six weeks" prior to admission. This protrusion was described as an irregular tumor mass projecting between the lids. The diagnosis was retinoblastoma and the eye was enucleated. Five X-ray treatments to the right orbit were given.

The father signed a release and removed the child. By court order, 10 weeks later, the child was returned to the hospital with a discharging ulcerating mass in the right orbit. At this time a white mass, three times the size of the disc, was discovered in the left eye.

X-ray therapy was continued until shortly before death seven months after the first admission. No autopsy was obtained. The pathologist reported glioma of the retina; tumor tissue was noted in the vitreous which was not believed to be continuous with the tumor outside of the eye. None of the sections were found for further study.

The second child, a boy, was admitted to the hospital one year after birth with a history of striking his left eye against a box one week prior to admission. The conjunctiva was injected and the eye was evidently painful.

Examination of the allegedly injured left eye revealed a small mass on the iris and a white mass in the vitreous. In the right eye a yellowish mass was seen extending into the vitreous from the retina. The tension was increased in the right eye, but not in the left eye. X-ray studies of the skull were negative.

A diagnosis of bilateral retinoblastoma was made and both eyes were enucleated. This child was placed in the Ohio State Institution for the Blind under a guardian appointed by the court. His adjustment was rapid, progress in school was very satisfactory and according to the latest information he is living and well.

Following is an abstract of the report confirmed by the Armed Forces Institute of Pathology, Washington, D.C.:

The right eye revealed a retinoblastoma with typical rosettes. The left eye revealed a vitreous partially filled with a mass of necrotic tissue. The edge of this mass which was calcified suggested the appearance of retinoblastoma. There was active invasion of this mass by young granulation tissue arising from the choroid (fig. 2-a).

The optic disc was covered by granulation

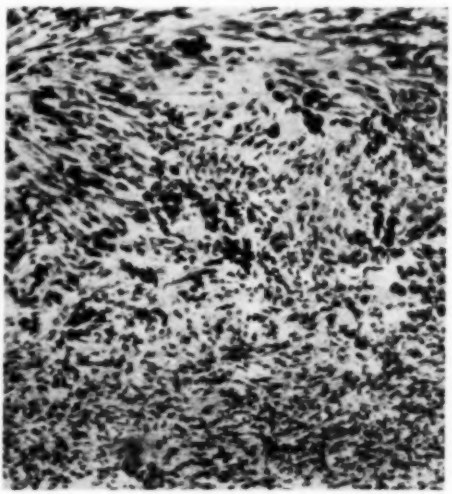

Fig. 2-a (Sovik). Invasion of optic nerve by pigment.

tissue in which there was a layer of cells evidently derived from the retinal pigment epithelium. Surrounding the tumor and also extending down into the optic nerve were masses of pigment held in wandering cells (fig. 2-b).

An interesting feature of this specimen is the marked necrosis with secondary invasion of fibroblasts. Reese states that this type of tumor has little tendency to invade fibrous tissue.[5] On the other hand, fibrous tissue may invade the tumor but the tumor may, by its rapidity of growth, outstrip its blood supply and become necrotic leading to its arrest, suppression, and retrogression. This specimen illustrates an early stage of retrogression, permanent or temporary, with beginning phthisis bulbi.

The third and fourth children, aged 15 and 17 years, respectively, have remained normal to this time.

The fifth child, a girl, the third to be affected, was admitted to the hospital at the age of three years, somewhat more than six months "after she was kicked in the right eye." Following this accident her eye became inflamed and vision was lost. Shortly after involvement of the right eye, the left eye became blind.

Examination revealed the right eye to be microphthalmic with a white pupil. The left eye was soft but normal in size, also with a white pupil. The fundi could not be seen. The child was mentally retarded and had spastic paralysis. X-ray studies of the skull were negative. The patient was removed from the hospital by the father without further examination and no treatment.

Fig. 2-b (Sovik). Invasion of tumor by fibroblasts.

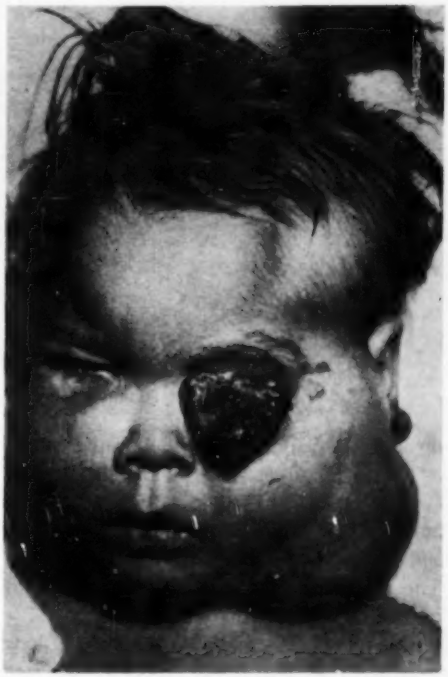

Fig. 3 (Sovik). Gross appearance of third child affected. Note metastatic tumors on head, face, and neck.

She was readmitted 17 months later with metastatic tumors on the head, face, and neck (fig. 3). X-ray studies of the skull were negative but the long bones showed demineralization. The child died one month after the second admission.

Pathologic examination of the eyes. The right eye was small, shrunken (0.9 by 1.3 by 1.5 cm.). The left was filled by a mass of tissue, dark-red at the periphery and yellowish-tan with irregular calcification in the central portion. A reddish tumor was adherent to the atrophic optic nerve at its emergence

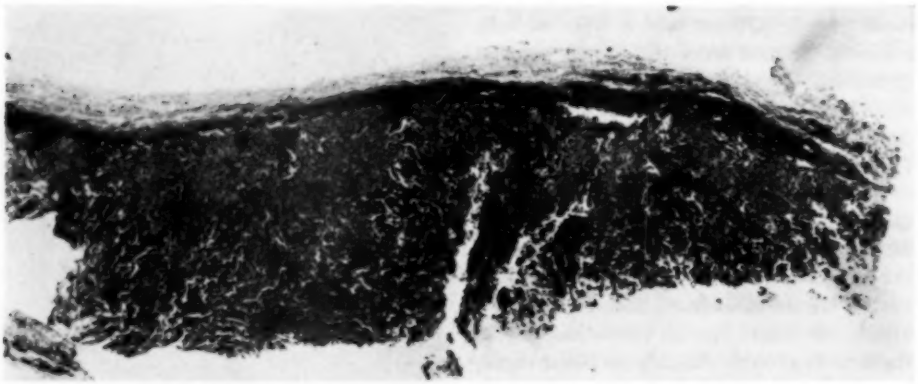

Fig. 4 (Sovik). Tumor cells along optic nerve (left eye—low power).

through the foramen into the cranial cavity.

The left eye was surrounded by a mass (measuring 3.5 by 4.5 by 5.5 cm.), and a tumor of varied color exhibiting necrosis and calcification completely filled the eye. The sclera appeared intact; the cornea was infiltrated by the protruding mass.

The tumor cells of both eyes were in long strands. The intraocular tissues consisted chiefly of necrotic tumor cells, polymorphonuclear cells, pigment cells, debris, hemorrhage, calcium plaques, and bone formation.

The tumor in the left eye extended along the optic nerve sheath through the optic foramen, entering the cranial cavity (fig. 4).

Figure 5 shows tumor cells in the right orbital tissue which are believed to be an extension from the left eye. Reese[5] cites a similar case proven at autopsy.

The right eye represents a later stage of retrogression and atrophy than the previous case (fig. 2). However, living tumor cells remain which may produce a recurrence and extension. Knapp,[6] citing several cases, states that though retrogression and atrophy may occur, recurrence is frequent.

The sixth child, a boy, was admitted to the hospital at the age of 16 months with a history of enlarged vessels in a painful right eye. Several weeks after this a white pupil was noted. Examination of the right eye revealed three grayish elevated folds of the retina. The fundus of the left eye appeared to consist of gray degenerated fibrous strands. X-ray studies were negative. Enucleation was advised but the parents refused and removed the child from the hospital.

By court order, two and a half months later, the child was returned to the hospital. At this time the tumor on the right side had penetrated the anterior portion of the globe and was invading the subconjunctival tissue. X-ray studies of the skull revealed erosion of the lateral half of the superior border of the right orbit.

Bilateral enucleation, postponed one month because of bronchial pneumonia, was followed by X-ray therapy. The child, by this time, was an emaciated vegetative infant with large palpable nodes in the cervical and preauricular areas. A right facial paralysis was present. Spinal puncture prior to death revealed a fluid pressure of 250 mm. of water; protein, 1,040 mg. percent, and cell count of 1,250 with many tumor cells.

Pathologic examination of the eyes. The right eye was covered by a tumor. It was about four cm. in diameter. In cross section, the optic nerve was enlarged and dark in color. Tumor tissue filled the globe. A black pigment line, probably the remaining choroid, enclosed a mass of pinkish, soft-looking tissue studded with white chalky dots. The tissue between the choroid and sclera and the

mass outside of the globe appeared firm and of uniform consistency.

The left globe was normal in size (24 mm.) and shape. Save for a cataractous lens the anterior segment grossly appeared to be normal. When opened the eye contained a tumor about one cm. in diameter. The cut surface of the tumor was pale white and studded with chalky dots. The anterior part of the retina was detached and thrown into folds over a mass resembling partially organized hemorrhage which projected inward from the region of the ora serrata. Microscopially, there were acini of proliferated pigment epithelium in this mass. The rest of the retina was involved in a tumor arising at the optic disc. There were small implants of tumor tissue and small independent foci of tumor cells in the anterior folds of the retina.

The tumor proper had the characteristic appearances of retinoblastoma. There was extensive necrosis and some calcium deposit. Near the optic disc where necrosis was scant, the tumor cells showed marked tendency to be arranged in pseudorosettes. Tumor cells had invaded the optic disc and a small group of them is seen in the choroid but no extraocular extension of the tumor was seen and there was no invasion of the optic nerve behind the lamina cribrosa.

The right eye showed anterior extension by a cellular tumor which had destroyed the cornea. In this mass there was very little necrosis and no calcium. The lens was intact and cataractous. Within the globe the tumor tissue was largely necrotic. Microscopically, tags of the attached extraocular muscles showed invasion by tumor cells. The tumor extended along the optic nerve and there was infiltration of the base of the brain. Cerebral congestion and edema were noted. The patient also had a fibrocaseous tuberculosis of the right lung and hilar lymph nodes were involved.

There is little to demonstrate in the right eye due to the destruction of the tumor but the sections from the left eye beautifully il-

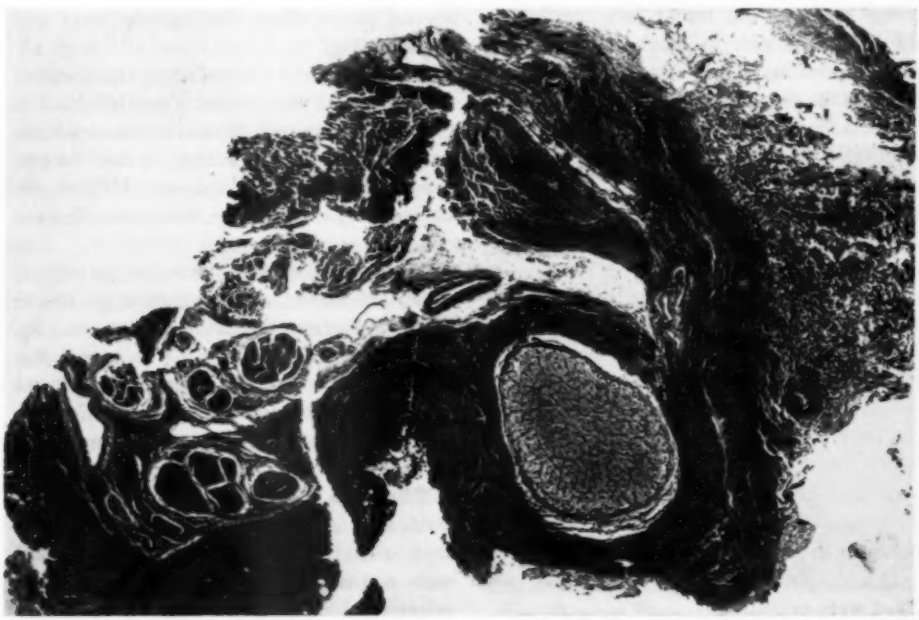

Fig. 5 (Sovik). Tumor cells in right orbital tissue (low power).

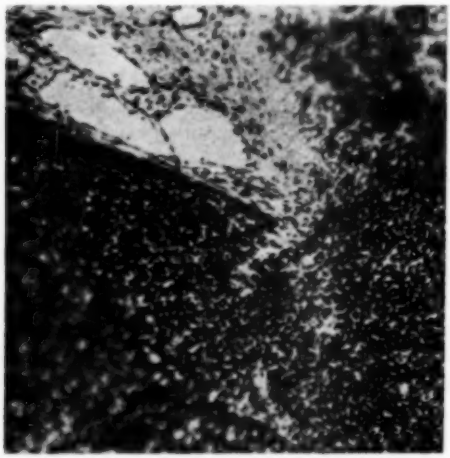

Fig. 6 (Sovik). Invasion of choroid and optic nerve by tumor.

lustrate pseudorosettes and an early invasion of tumor cells in the choroid (fig. 6). Extension is seen along the optic nerve into the brain.

Reese[8] found this direct extension in 52 percent of the cases reported. In his recent series[9] he found that tumor cells invaded the choroid in 25 percent of the cases and 10 percent penetrated by way of emissary veins through the sclera. Blood-stream or lymphatic metastases are quite possible from this location.

The eighth child, the fifth affected, a boy, was admitted by court order at the age of two and one-half years, one year after the parents noted loss of vision in both eyes.

At admission the right eye was enlarged, the cornea measuring approximately 15 mm. in diameter with opaque center. A cataractous lens was dislocated posteriorly. A yellowish mass was seen in the nasal area of the vitreous. In the left eye a large granular white mass was seen in the upper nasal vitreous with scattered seedlings over the remaining retina. Another smaller mass was noted in the lower temporal quadrant.

X-ray studies of skull, long bones, and chest were negative.

Both eyes were enucleated. The child was discharged to the Boston Nursery for the Blind and according to the last report is well.

Pathologic examination of the eyes. The right eye was slightly enlarged (25 by 22 by 22 mm.) and hard, with cornea measuring 14 by 12 mm. A posterior staphyloma was present. The lens was partially calcified. Microscopically, the retina was degenerated and detached in a fibrous mass composed of tumor cells forming rosettes filling the vitreous chamber and fusing behind the lens with a vascularized cyclitic membrane. Many areas of necrosis, cystoid degeneration, and calcification were identified. The tumor cells were seen invading the optic nerve not much beyond the lamina cribrosa. No extension was noted in the emissaries.

The left eye was of about normal size. Two larger and several smaller masses of tumor cells were present. Microscopically, one of the masses arose from the outer nuclear layer. The invasion of these cells seemed to be limited by the internal limiting membrane and by Bruch's membrane. However, Bruch's membrane had been broken in several places where the pigment layer was degenerating.

The tumor cells formed many true rosettes of Flexner-Wintersteiner (fig. 7). Within these tumor masses there was degeneration, scattered pigment migration, cystoid formation, and plaques of calcium. Neither the optic nerve, studied in serial section, nor the emissaries were invaded.

The microscopic section seems to support those who state that the tumor originates in the outer nuclear layer. The illustration (fig. 8) indicates that none of the layers are disturbed except the outer nuclear layer. The beautiful rosettes are reminiscent of Flexner's[8] original paper and description of the rudimentary rods and cones.

The ninth child was a boy who was the sixth affected. Little history is available but we learned through the family physician who was instrumental in obtaining the court order for admission that he found no abnormalities in the eyes at birth or at six weeks.

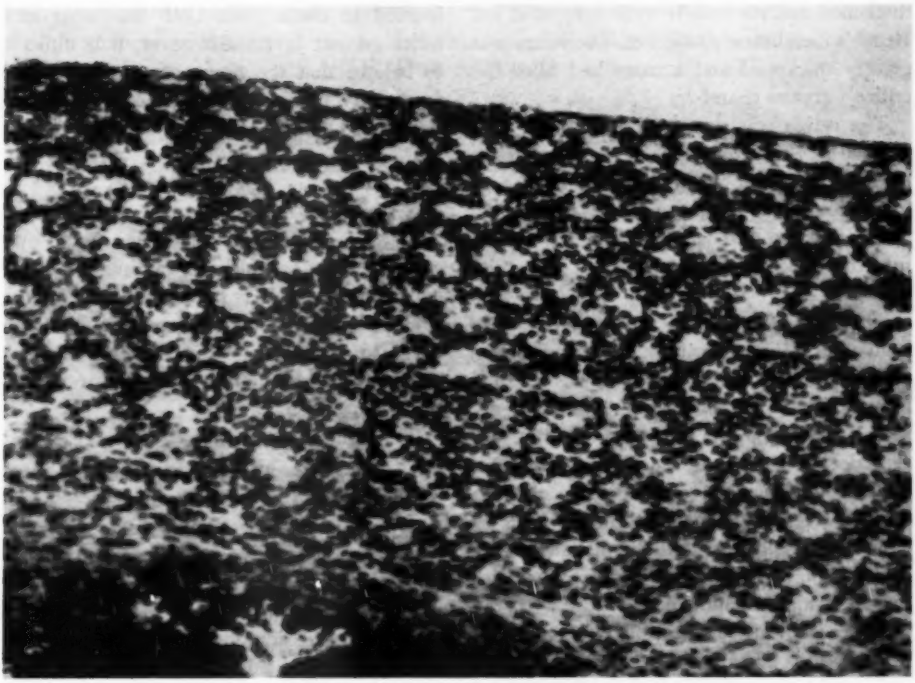

Fig. 7 (Sovik). True rosettes of Flexner-Wintersteiner.

At the age of four months, the father noticed a change in the right eye.

Examination at admission revealed a small right eye about one-third normal size which did not react to light. A cataractous lens was displaced into the anterior chamber. The iris was adherent to the cornea nasally and to the lens. The fundus could not be visualized.

The left eye had a normal anterior segment; the pupil reacted to light. Ophthalmoscopy revealed a gray elevated white mass involving the temporal half of the retina with large dilated vessels running over its surface. X-ray studies of the skull were negative.

Bilateral enucleation was done. The patient was discharged to the Boston Home for the Blind and the latest reports are that he is living and well.

Pathologic examination of eyes. The right eye was a small, irregular, shrunken globe measuring 13 by 10 by 15 mm. Microscopically, the ciliary process and ciliary body had lost their identity fusing behind the cataractous lens into a large fibroblastic and degenerating mass. The choroid was greatly

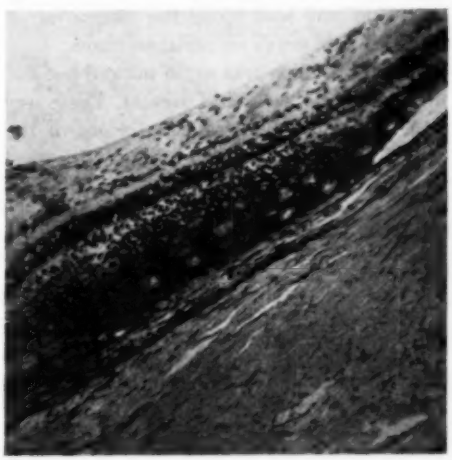

Fig. 8 (Sovik). Retinoblastoma arising from the outer nuclear layer.

thickened and its vessels were congested but Bruch's membrane was intact. The sclera was greatly thickened and a mass had filled the entire vitreous chamber.

The retina was detached. The tumor cells formed few rosettes. Here, areas of necrosis, calcification, fibroblastic proliferation, pigmentation, and hemorrhage were noted. There was no extension of the tumor cells into the optic nerve or by way of the emissaries.

The left eye was firm and of normal size with a normal anterior segment. The vitreous appeared to be clear. The retina was invaded by two white oval masses which partially detached the retina and extended into the subretinal space. One of the tumors extended temporally from the optic disc to the ora serrata covering the macula. The other tumor extended nasally just half the distance to the ora serrata. Both tumors were sprinkled with brown opaque calcium specks.

Microscopically, many cells were arranged in tiny true rosettes. The cells alternately stained deeply in groups around the blood vessels and faintly farthest from the vessels to form necrotic patches and calcium deposits. Beneath the degenerating and detached retina, a serous exudate was noted. There was no invasion of the choroid. No extension was seen along the emissaries or into the optic nerve on serial sections.

A retrogression was again noticed but living tumor cells were still present. These sections did not demonstrate the origin of the cells from the outer nuclear layer for they seemed to come from both the inner and outer nuclear layers. However, it is difficult to believe that the point of origin is more frequently the inner nuclear layer as mentioned by Duke-Elder.[1]

Summary

Six siblings have been presented in whom bilateral retinoblastoma had been found and confirmed by pathologic examination of 11 enucleated eyes. It is noted that three of the first four siblings who had enucleations from 15 to 33 months after birth did not survive. The only one living of this group of four is the second child.

Three interesting features were presented:

1. One of the cases suggests involvement of the orbital tissue of the other eye by intracranial extension.

2. Evidence is given to support the theory that retinoblastomas originate from the outer nuclear layer.

3. Retrogression does occur but in this tissue living tumor cells are present which may be stimulated to growth.

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POLYARTERITIS NODOSA OF THE EYE*

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Polyarteritis nodosa has been classified in recent years as a collagen disease, and as such takes its place with rheumatoid arthritis, rheumatic fever, diffuse lupus erythematosis, dermatomyositis, scleroderma, and a few others as an inflammatory and degenerative disease of the connective-tissue system.

It has long been believed that the connective tissues of the body were merely supporting tissues for the various organ structures. Recently a new concept has arisen, and it seems probable that the connective tissues form a system somewhat as the vascular and nervous mechanisms do, and that this system has functions other than that of support. Among these activities may be that of the transfer of metabolites and maintenance of the salt and water balance,[1] and the destruction of worn-out blood cells and the formation of new ones.

There are many disputed points about the formation and functions of the connective tissue system. It is commonly believed, however, that the collagen fibrils and ground substance are both formed from the fibroblasts of areolar tissue. Why the collagen is subject to the peculiar type of necrosis known as fibrinoid degeneration is unknown, but this is one of the characteristics of all so-called collagen diseases.

Polyarteritis or periarteritis nodosa or, more recently, essential polyangiitis, is characterized by focal lesions of the small and medium-sized arteries, beginning in the adventitia or media, and later involving the intima. It is a disease of such bizarre signs and symptoms that often the diagnosis is made first at autopsy.

Harris[2] and his co-workers reviewed the American literature up to June 1, 1938, and found reports of 101 cases. Of these only 26 were diagnosed ante mortem. The organs involved in order of frequency were kidneys, heart, liver, spleen, lungs. Harris makes no mention of eye disease. In 53,000 admissions to Peter Bent Brigham Hospital, eight cases were diagnosed (0.015 percent). The average span from onset of symptoms to death was 8.6 months, although one patient lived 12 years. The mortality is well over 90 percent.

The most frequent clinical findings are irregular fever, leukocytosis, albuminuria, abdominal pain, edema, vascular hypertension, and loss of weight. Joint pains and swellings, skin eruptions, and evidence of myocardial infarction are common. Eosinophilia and the appearance of subcutaneous nodules may aid in the diagnosis, but these nodules occur in less than 20 percent of the cases. Biopsy of a piece of muscle or of a subcutaneous nodule usually establishes the diagnosis.

Arkin[3] divides the pathologic picture of polyarteritis nodosa into four stages: degenerative, acute inflammatory, granulation, healed.

First a hyalinelike necrosis begins in the media and rapidly affects the adventitia and intima. Other observers believe the process starts in the adventitia. Infiltration of the media and adventitia occurs with polymorphonuclear neutrophils and sometimes with many eosinophils, lymphocytes, and plasma cells. Aneurysm formation or rupture of the vessel wall may occur in this stage. Proliferation of fibroblasts takes place, with increase in lymphocytes and plasma cells. These fibroblasts may penetrate the entire wall and tissues around the arteries. Intimal thickening may occlude the lumen of the vessels.

* From the Departments of Ophthalmology and Pathology, Baylor University College of Medicine. Presented at the 87th annual meeting of the American Ophthalmological Society, White Sulphur Springs, West Virginia, June, 1951.

† By invitation.

The last stage is scar formation, in which there is a thick mantle of fibrous tissue about the arteries. For some unknown reason the veins are usually not involved in the process. The nodules, which are characteristic of the disease when present, are formed by aneurysmal dilatations, inflammatory exudates or fibrous overgrowths. As the stages pass rapidly from one to the other, the results of biopsies may differ considerably if taken a few days apart.

Etiology

The cause of polyarteritis nodosa has been obscure since it was first described by Kussmaul and Maier[4] in 1866. Arkin[5] thought it was caused by a filtrable virus. Gruber[5] suggested in 1923 that it was due to hypersensitivity. Rich[6] and Rich and Gregory[7] have shown that typical lesions may be produced by injections of horse serum, and they have given a convincing argument backed by clinical cases and by animal experimentation that the disease is caused by some allergen, the origin of which may be obscure. Hopps and Wissler[8] confirmed this work in rabbits, producing the same lesions although somewhat less severe and not so generalized.

Not many cases of eye involvement in polyarteritis nodosa have been reported in the literature. Stillerman[9] in a very recent paper states that of the more than 550 cases in the literature only 10 percent had demonstrable eye lesions. We have not attempted to search out all the cases recorded, but our reading leads us to believe that this estimate is about right. This may well be because no mention is made of eye findings in a great many reports, and presumably the eyes were not examined.

Goldstein and Wexler[10] reported the first case of eye involvement in the American literature in 1929, and they stated that the only other reference was in 1899 by P. Muller, who said, "The same changes were found in the retinal arteries as in the small vessels of the brain." Goldstein and Wexler's case showed normal fundi and microscopically the lesions were confined to the choroid.

The same year Böck[11] reported a case in which typical changes were found in arteries, in the internal rectus muscle, and in small vessels about the entrance of the optic nerve. Böck stated that, previous to his report, Christeller had mentioned casually that he found polyarteritis nodosa in the choroid.

Friedenwald and Rones[12] reported on a man, aged 55 years, who before death had edema of the retina and optic disc. Histologically, in addition to extreme arteriolar sclerosis in the retina and choroid, there were several nodular thickenings with fibrosis of the adventitia and infiltration with mononuclear cells.

Gaynon and Asbury[13] described the eyes of a 38-year-old Negro who prior to death had bilateral papilledema and all the evidence of hypertensive retinopathy. The changes in the arteries of the choroid were typical of polyarteritis nodosa, but the vessels of the choriocapillaris were relatively unaffected.

Goldsmith[14] reported a case that showed ophthalmoscopically a fusiform aneurysmal dilatation of the inferior temporal artery as well as papilledema, hemorrhages, and exudates which he attributed to optic neuritis. The histologic sections were unfortunately not made through the aneurysm, and characteristic changes were not found in the retinal arteries, but the choroidal vessels were typical of the disease. Goldsmith states that only four cases with histologic evidence of involvement of the retinal vessels had been reported prior to his study in 1946.

Because of the scarcity of histologic studies and the possible beneficial effect of hormone therapy, such as adrenocorticotropic hormone and cortisone, two additional cases are reported.

Case reports

Case 1

A 30-year-old Mexican was admitted July 9, 1950, to the medical service of the

Veterans Administration Hospital, Houston. He complained of diminishing vision in the left eye for three months, headaches for the same period, and more recently pains in the upper abdomen. Hematuria occurred three days before admission. His systolic blood pressure was 250 mm. Hg, diastolic 150 mm. Hg, and he was acutely ill on admission. He had a persistent but irregular fever, blood in the urine, and leukocytosis up to 30,000 per cu. mm. on several counts. He complained bitterly of muscular soreness and of pain in the right upper abdomen.

A biopsy was done from the deltoid muscle. The biopsy record states, "The microscopic appearance of the involved artery is compatible with that of periarteritis nodosa; however, the lack of similar involvement of other vessels does not allow a final diagnosis."

Fundus examination revealed a third-grade sclerosis of the vessels, fresh exudates, and a hemorrhagic area in each retina. The left disc showed secondary atrophy.

The patient died August 1, 1950, after an illness of scarcely more than four months. The autopsy report was periarteritis involving gall bladder, small intestine, kidneys, with rupture of right perinephric hematoma; cardiac hypertrophy; pneumonia, focal, bilateral; ulcers, chronic, peptic, duodenal.

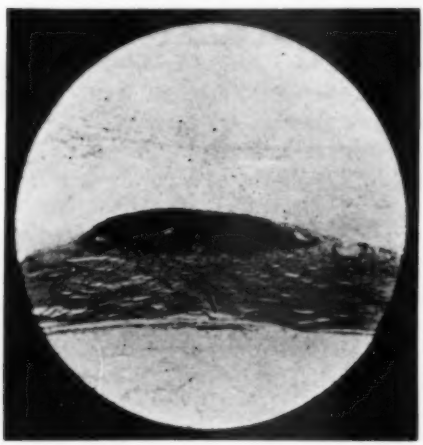

Fig. 1 (Goar and Smith). *Case 2.* Episcleral nodule of polyarteritis. (Hematoxylin and eosin stain.)

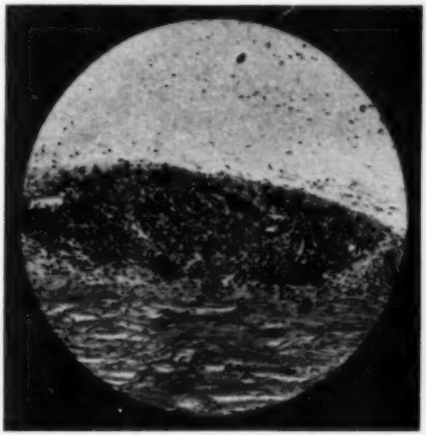

Fig. 2 (Goar and Smith). *Case 2.* Different site of same artery, exhibiting giant cells. (Hematoxylin and eosin stain.)

The following is taken from the pathologic description, the irrelevant part being omitted.

"The episcleral vessels are thickened and a light sprinkling of lymphocytes and plasmacytoid cells are scattered throughout the episclera. The filtration angles are open, but posterior synechias are on the nasal side. The iris is deeply pigmented and the vessels are hyalinized. The retina is greatly distorted, this change being most marked in the posterior quadrant. Clear cystic areas, round and oblong, replace the fibers of the nerve fiber layer and inner plexiform layer posterior to the equator.

"At the shoulders of the papilla hemorrhage is widespread in the nerve fiber layer on the nasal side, while smaller ones occur temporally. Scarring by gliosis distorts the inner layers near the papilla temporally. Cystic changes in the papillary shoulders within the nerve fiber layer are marked, leaving on the temporal side a thin strand of inner limiting membrane traversing the cystic depression. At the base of this cyst, fibrinous strands form a collection enmeshing large cells made up of abundant granular cytoplasm with large round nuclei; this appears to be a cytoid body. The pigment

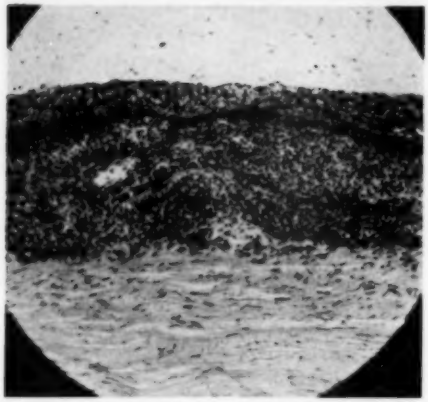

Fig. 3 (Goar and Smith). *Case 2.* Polyarteritis nodosa of episcleral artery. There is thickening of the vessel wall by dense inflammatory-cell infiltrate. Prominent hyalin membrane of the media is shown. (Hematoxylin and eosin stain.)

epithelial cells are focally proliferating, projecting into the layer of rods and cones, distorting them and in some areas they are absent.

"Many arteries of the choroid are thick-walled, leaving either a pinpoint lumen or no visible lumen within. The central retinal artery is markedly sclerotic.

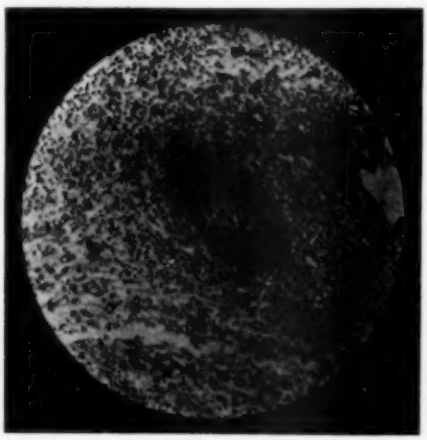

Fig. 4 (Goar and Smith). *Case 2.* Vessel in medulla of kidney, showing necrosis of wall and blocking of lumen. Neutrophils (many eosinophils), plasmacytes, and lymphocytes have infiltrated the wall and adventitia. (Hematoxylin and eosin stain.)

"Tissues of the papilla and optic nerve are separated and swollen, protruding laterally to the margin of Bruch's membrane, both anterior and posterior to it. The hyaloid membrane is readily visible on the temporal side and appears to have contracted, leaving the retinal layers convoluted. Minimal cystic changes replace the inner zone of the rod and cone layer at the equator. Ganglion cells are reduced in number. The majority of the extrascleral arteries are thick-walled, leaving little or no lumen; this change is most marked in the smaller vessels."

Case 2

A 31-year-old white woman was admitted to Hermann Hospital March 2, 1950. The previous winter she had had a severe sore throat and virus pneumonia. She had complained for several weeks of severe migratory joint pains, without redness or swelling. She had been treated with all available antibiotics without relief, and she had developed a skin eruption that was thought to be due to penicillin.

The patient was acutely ill when she entered the hospital. She ran an irregular temperature and soon passed blood in her stools and urine. The blood pressure was never elevated. The leukocyte count varied from 11,000 to 30,000 per cu. mm., and the

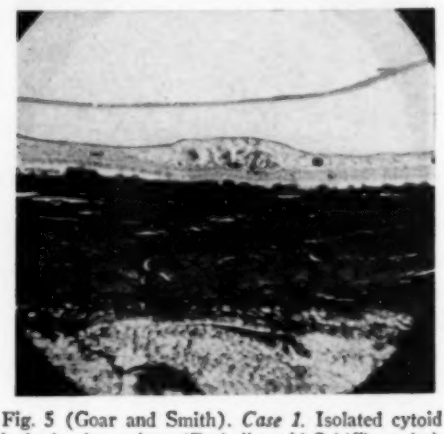

Fig. 5 (Goar and Smith). *Case 1.* Isolated cytoid body in the retina. (Periodic acid-Schiff's stain.)

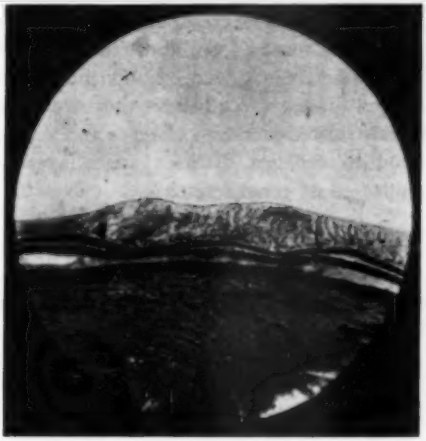

Fig. 6 (Goar and Smith). *Case 1.* Two cytoid bodies in second retinal layer. (Periodic acid-Schiff's stain.)

eosinophil count ranged from seven percent to 27 percent. A shift to the left occurred in the differential count as her condition grew worse.

The patient's eyes seemed normal on admission but there is no record that her fundi were examined. During her stay in the hospital, she developed acute anterior uveitis, first in the right eye, then in the left. This improved under local treatment but before death an infiltration appeared at the corneoscleral junction above, in both eyes.

Evidence of pulmonary and heart involvement appeared and her condition grew steadily worse. She died four weeks after entering the hospital. The anatomic diagnosis on the autopsy record was disseminated arteritis, involving small arteries of the kidney, gastrointestinal tract, and mesentery; subacute endocarditis; diffuse involvement of kidneys by focal emboli; multiple infarcts of the spleen; ulcerations of the esophagus, ileum, and colon; hydropericardium; bilateral hydrothorax; hydroperitoneum.

The histologic description of an eye removed at autopsy is as follows:

"Microscopic findings: the vessels of the corneal-scleral junction are increased in size

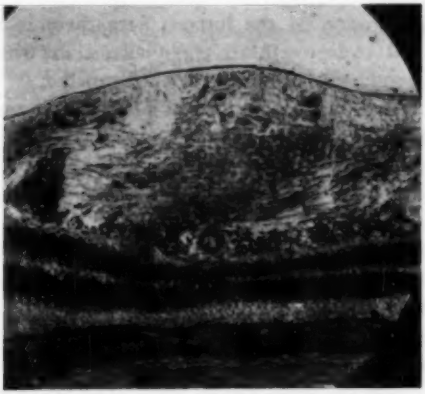

Fig. 7 (Goar and Smith). *Case 1.* Cytoid body in nerve-fiber layer of retina in polyarteritis nodosa. (Hematoxylin and eosin stain.)

and number, and are surrounded by an infiltration of neutrophils, lymphocytes, and macrophages and a few eosinophils. There is moderate chemosis of the limbal tissues. Vessels throughout the episclera show proliferation of endothelium with partial and complete obliteration of the lumina as well as focal and discrete inflammatory cell infiltration. A large scleral nodule at the nasal equatorial region has undergone necrosis and

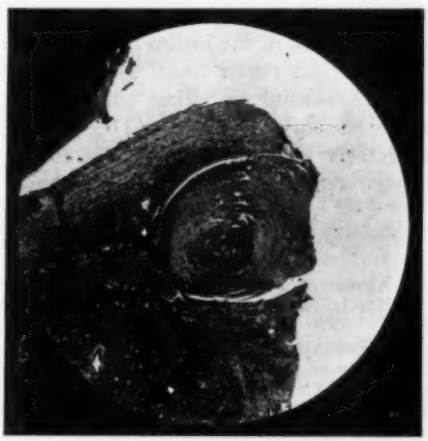

Fig. 8 (Goar and Smith). *Case 1.* Coronary artery with marked fibrous replacement and obliteration of lumen. (Hematoxylin and eosin stain.)

obliteration of the lumen; here there is a great overgrowth of endothelial cells with a production of giant cells in the media.

"A prominent thick eosinophilic membrane is located throughout the media. Foci of lymphocytes occur throughout the choroid. Peripheral anterior synechias have formed, and the filtration angle and Schlemm's canal are obliterated and infiltrated with small numbers of neutrophils, lymphocytes, and macrophages. The retinal layers are well preserved and a few pigmented macrophages have migrated into the retina.

"On the nasal side of the cornea near the limbus a small superficial ulcer has formed which is primarily in the area of vessel necrosis and consists of large numbers of macrophages, neutrophils and lymphocytes in the anterior one-third of the corneal stroma. These cells have perforated through the corneal epithelium. There is a mild lymphocytic plasma cell infiltration and fibroplastic proliferation in the arachnoid about the entrance of the optic nerve."

Discussion

Polyarteritis nodosa apparently has two effects on the eye. The first is direct as manifested by the typical thickening of the wall and diminution of the lumina of the arteries of the various ocular coats. The second is indirect, resulting in retinal edema, transudates, hemorrhages, and cytoid body formation; these changes are probably effected through renal alteration leading to hypertension. Some observers suggest that the cytoid body results from fibrinoid degeneration and hence may be a common finding in collagen diseases. We believe they are more directly related to kidney changes and will be found in collagen diseases which are accompanied by renal lesions.

Summary

1. Polyarteritis nodosa is a focal degenerative and inflammatory disease affecting the small and medium-sized arteries and is characterized by a peculiar type of hyaline-like necrosis known as fibrinoid degeneration. Around these areas quickly appear cells indicative of acute inflammation. The process rapidly passes through the degenerative, inflammatory, and granulation stages to that of overgrowth of fibrous tissue.

2. The nodules from which the name is derived appear in only about 20 percent of cases and are caused by aneurysmal dilatation, exudation, or excessive fibrosis.

3. Relatively few cases of eye involvement have been recorded, but this may be due to the fact that the eyes have frequently been overlooked in the examination. In the eyes the characteristic changes are most often found in the choroid, but the retinal, ciliary, muscular, and episcleral arterial branches may be affected.

4. Two cases are added of eye involvement, one of which was diagnosed by biopsy and the other at autopsy.

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THE EFFECT OF LOBOTOMY AND ELECTROSHOCK ON INTRAOCULAR PRESSURE*

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Our knowledge of the cerebral factors involved in the regulation of intraocular pressure is still in a very incomplete state. Some authors have postulated the existence of a separate center in the brain for the control of ocular tension. Schmerl and Steinberg[1] believe that there are distinct diencephalic centers both for pupillary motility and ocular tension.

Whatever may be the mechanism that maintains the relatively constant state which characterizes normal tension, there is a steadily increasing volume of literature suggesting that altered nervous action is a most important factor in the production of increased intraocular pressure.

Magitot[2] believes that an anxiety state exists in glaucoma and has implicated a hyperexcitable thalamus. Hibbeler,[3] investigating personality patterns in glaucoma patients, found that 66 percent had psychopathic deviation, as compared to five percent in a control group.

Ripley and Wolff,[4] studying a group of 18 patients with glaucoma, found that the appearance and exacerbation of eye symptoms and signs coincided frequently with stressful life situations and emotional reactions of anger, anxiety, or depression, and rarely with feelings of happiness.

They considered that the increase in intraocular pressure represented an inappropriate and ineffectual biologic reaction pattern of mobilization and that such a response is especially common in the aging period when there frequently is a decrease in the flexibility and effectiveness of psychologic and physiologic mechanisms maintaining homeostasis.

It occurred to us to investigate the changes, if any, in intraocular pressure which occur following lobotomy, when the frontothalamic fibers are cut, and in electric shock where a more diffuse affection of the cerebrum is obtained. Both of these procedures were performed as regular therapeutic measures on mental patients at the Toronto Psychiatric Hospital, where our investigation was carried out.

LOBOTOMY

The operation of lobotomy is used for the relief of certain types of mental illness. Recent studies suggest the possibility that every area in the cerebral cortex has its representation in the thalamic nuclei and that a double-track circuit to and from the thalamus exists. This relationship between cerebral cortex and thalamus is a very intimate one. No irritation of the cortex can take

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place without producing a like stimulation of the thalamus, indicating that a mutually interlacing circuit is present.

The operative procedure consists of introducing a leukotome through burr-holes made over the frontal lobes and severing the frontothalamic fibers. This is done bilaterally. Pathologic studies following this operation show that degeneration of the dorsomedial nucleus is a constant finding. Damage to the anteromedial and lateroventral nuclei may also occur.

From these findings, it is suggested that the dorsomedial nucleus is the anatomic substrate for emotional experience—that it is a relay station for transmission of impulses originating in the hypothalamus to the frontal lobe.

The most common mental change manifested in the individual in the postlobotomy state is relief from fear. Many abnormal affective states, such as agitation, tension, anxiety, or depression peter out after lobotomy.

Intraocular pressure was recorded using a certified Schiøtz-Sklar tonometer. Readings were taken at the same time of day in each instance. For corneal anesthesia, 0.5-percent pontocaine solution was used. When possible, readings were taken on three different occasions, several days apart, before and after lobotomy.

We were well aware of the possibilities of error in comparative readings with the tonometer. This difficulty was much increased in dealing with mental patients; often on a particular day no reading could be obtained, due to poor coöperation.

Unfortunately for our purpose, one of the effects of the operation was that some patients were unable to carry out tasks requiring deliberation or sustained attention. For this reason, we were forced to drop many cases from our investigation. Good readings had been obtained preoperatively but the postoperative mental state was such that tonometry was impossible.

The result of our investigation of 14 cases, on whom lobotomy was performed for schizophrenia and psychoneurosis, is shown in Table 1. None of these patients showed any ocular pathologic process. A study of this table shows that, after due consideration is given to the technical errors inherent in comparative tonometry, there is no definite change either in the direction of raised or lowered tension. The implications of these findings will be discussed later in this article.

Electroshock

In electroshock, the effect is diffused over a much wider area of the brain than in lobotomy. The current passing through the cerebrum stimulates and depresses the activity of the brain cells. The threshold for stimulation and depression for different types of cells is apparently fixed at various levels for each group of cells. This is manifested by convulsive seizures and loss of consciousness.

Experimental work on animals has shown that damage to the ganglion cell is present although it is temporary and reversible. The apnea lasting up to one minute undoubtedly causes anoxia and there is some alteration of brain metabolism, the exact nature of which is unknown.

For the treatment of our cases, 60-cycle, alternating current was used. The estimated current delivered to the patient ranged from 500 to 600 milliamperes at 110 to 130 volts for 0.1 to 1.0 seconds.

The first tonometric reading was taken immediately before shock, with the patient lying on the treatment table in readiness for the current. The cornea was anesthetized with 0.5-percent pontocaine solution. With very few exceptions the coöperation of the patients was good.

The second tonometric reading was taken as soon as the convulsions ceased and the eyes had returned to direct gaze. This interval varied from one-half to two minutes. No further corneal anesthesia was required.

The results are shown in Table 2. A study of this table reveals that, in 18 cases, there was a sharp rise of intraocular pressure; of the two remaining cases, one showed no

TABLE 1

THE EFFECT OF LOBOTOMY ON INTRAOCULAR PRESSURE

Case	Age	Date of Lobotomy	Intraocular Pressure (mm. Hg Schiøtz) Before Lobotomy			After Lobotomy		
			Date	R.E.	L.E.	Date	R.E.	L.E.
M. D.	42	11/ 5/50	3/ 5/50	17	17	17/ 5/50	17	17
L. M.	37	16/ 8/50	2/ 8/50	13	12	18/ 8/50	14	11
			5/ 8/50	17	17	28/ /850	13	14
R. W.	33	7/ 9/50	2/ 8/50	10	10	13/ 9/50	16	—
			5/ 8/50	11	11	19/ 9/50	13	13
			8/ 8/50	14	13	20/ 9/50	13	—
J. L.	31	17/ 8/50	3/ 8/50	13	14	18/ 8/50	13	11
A. F.	38	9/11/50	27/10/50	17	23	14/11/50	12	15.5
			1/11/50	20	20	16/11/50	14	14
			3/11/50	21	20	22/11/50	17	17
M. A.	58	23/11/50	14/11/50	23	23	1/12/50	23	22
R. H.	61	23/ 2/51	31/ 1/51	23	23	7/ 3/51	17	17
			5/ 2/51	18.5	18.5	18/ 3/51	14.5	14.5
			7/ 2/51	16	17	21/ 3/51	14.5	14.5
J. D.	38	8/ 8/51	21/ 3/51	20	20	25/ 8/51	20	20
			2/ 4/51	20	20	29/ 6/51	17	17
			3/ 4/51	20	20	30/ 8/51	20	20
J. S.	45	27/ 4/51	2/ 4/51	17	14	30/ 4/51	16	13
			3/ 4/51	14	14	2/ 5/51	14	14
			6/ 4/51	17	17	3/ 5/51	14	14
E. A.	43	16/ 5/51	3/ 5/51	20	14.5	28/ 5/51	14.5	14.5
			7/ 5/51	17	17	29/ 5/51	17	20
			8/ 5/51	17	17	30/ 5/51	17	17
U. S.	32	30/ 5/51	28/ 5/51	17	20	2/ 6/51	23	23
			29/ 5/51	23	23	3/ 6/51	23	23
M. S.	61	27/ 6/51	6/ 6/51	23	23	3/ 7/51	20	20
			7/ 6/51	23	23	7/ 7/51	18.5	17
			8/ 6/51	23	23	17/ 7/51	20	20
G. G.	59	10/ 7/51	3/ 7/51	26	26	14/ 7/51	23	23
			6/ 7/51	23	23	17/ 7/51	23	26
			9/ 7/51	23	23	19/ 7/51	23	26
M. F.	38	25/ 9/51	25/ 8/51	17	17	1/10/51	20	20
			29/ 8/51	17	17	14/10/51	17	17
			30/ 8/51	17	17	16/10/51	17	17

change at all and the other practically none. The rise varied from 2.0 to 16 mm. Hg (Schiøtz), most falling within the range of 6.0 to 9.0 mm. Hg elevation.

Four or five minutes after shock treatment, the patients entered a period of excitement and no further reliable readings were obtainable for about 20 or 30 minutes. In eight cases the ocular tension was observed 30 minutes after the electroshock. The results are shown in Table 3. It will be seen that by this time the ocular tension had returned to previous levels.

Discussion

Examination of Table 1 shows that, after lobotomy, there is no definite change either in the direction of raised or lowered tension. We must conclude, therefore, that the maintenance of normal intraocular pressure does

TABLE 2

THE EFFECT OF ELECTROSHOCK ON INTRAOCULAR PRESSURE

Case	Age	Date	Intraocular Pressure (mm. Hg Schiøtz) Before Electroshock		After Electroshock	
			R.E.	L.E.	R.E.	L.E.
L. B.	58	15/3/51	23	23	24.5	24.5
		19/3/51	26.5	26.5	30	28.5
G. F.	51	15/3/51	26.5	26.5	32.5	32.5
M. S.	27	19/3/51	21.5	21.5	34.5	34.5
		21/3/51	23	23	24.5	24.5
		29/3/51	26.5	26.5	34.5	34.5
J. W.	52	28/3/51	26.5	28	32.5	32.5
M. E.	27	19/3/51	18.5	18.5	18.5	17
		21/3/51	23	23	21.5	18.5
		5/4/51	23	24.5	24.5	21.5
E. U.	25	28/3/51	17	17	26.5	30.5
		6/4/51	14.5	14.5	30.5	30.5
H. Z.	34	29/3/51	14.5	14.5	23	23
G. J.	19	29/3/51	17	14.5	26.5	23
		5/4/51	17	16	26.5	28.5
		19/4/51	16	13	26.5	23
M. H.	40	2/4/51	12	14.5	21.5	21.5
		3/4/51	14.5	14.5	20	23
		9/4/51	14.5	14.5	20	20
A. B.	45	5/4/51	23	23	30	26.5
		9/4/51	18.5	18.5	36	26
		3/5/51	23	23	30.5	30.5
E. McM.	36	9/4/51	17	17	20	18.5
		26/4/51	17	17	23	21.5
J. R.	21	16/4/51	17	17	23	23
		17/4/51	23	23	26.5	26.5
		9/5/51	23	23	26.5	26.5
J. Y.	33	17/4/51	23	23	23	23
		20/4/51	23	23	23	23
C. W.	46	14/4/51	23	23	34.5	34.5
D. A.	37	17/4/51	17	17	26.5	26.5
M. A.	64	25/4/51	23	23	28.5	28.5
		30/4/51	26.5	26.5	34.5	34.5
		9/5/51	24.5	24.5	30.5	30.5
C. M.	47	25/4/51	26.5	26.5	28.5	28.5
N. S.	35	28/5/51	17	17	23	23
		2/6/51	17	17	23	23
L. J.	46	15/5/51	17	17	23	23
		16/5/51	20	20	26	26
I. G.	66	16/5/51	18.5	18.5	26.5	26.5

TABLE 3

INTRAOCULAR PRESSURE, BEFORE ELECTROSHOCK, IMMEDIATELY AFTER, AND 30 MINUTES LATER

Case	Age	Date	Before Shock		Intraocular Pressure (mm. Hg Schiøtz) Immediately After		30 Min. Later	
			R.E.	L.E.	R.E.	L.E.	R.E.	L.E.
J. W.	52	28/3/51	26.5	28	32.5	32.5	26.5	26.5
G. J.	19	29/3/51	17	14.5	26.5	23	17	17
		5/4/51	17	16	26.5	30.5	17	17
		19/4/51	17	16	26.5	30.5	14.5	14.5
G. F.	51	19/3/51	26.5	26.5	32.5	32.5	26.5	23
M. H.	40	2/4/51	14.5	14.5	20	32	14.5	14.5
		11/4/51	14.5	14.5	20	20	14.5	14.5
A. B.	45	5/4/51	23	23	30.5	26.5	26.5	23
		9/4/51	23	23	30.5	30.5	20	20
V. M.	36	9/4/51	17	17	20	20	17	17
J. R.	21	16/4/51	23	23	26.5	26.5	23	23
C. M.	47	3/5/51	21.5	21.5	24.5	23	13	13

not depend upon the integrity of the frontothalamic fibers.

None of the patients under observation had glaucoma but some were cases of anxiety neurosis. If the anxiety state is a potential threat to the maintenance of intraocular pressure at physiologic values, one might venture the hypothesis that its removal would lower the tension. This, however, was not found to be the case.

In contrast to the lobotomy results, Tables 2 and 3 demonstrate clearly the sharp rise in intraocular pressure which followed electroshock. This elevation of tension does not depend on the degree of pupillary dilatation, which varied from very slight to complete. In none was the pupil contracted.

All cases, however, showed evidence of marked generalized circulatory congestion with increased systemic blood pressure and accelerated pulse rate. The convulsions are associated with a rise in venous pressure because of the violent muscular contractions. Anoxemia disturbs the autonomic nervous system and causes the liberation of epinephrine which further augments the venous pressure.

The rise in ocular tension is, therefore, most likely a vascular phenomenon, the combined effect of venous engorgement and raised arterial pressure causing an increase of blood volume within the eye, with a consequent elevation of intraocular pressure.

SUMMARY

A study has been made of the effect on intraocular pressure of lobotomy, or severance of the frontothalamic fibers, and of electroshock in an unselected group of mental patients, free from ocular disease. No demonstrable change occurred in the intraocular pressure after lobotomy but there was a sharp rise followed by a slower return to previous levels after electroshock.

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VARIATION OF ACCOMMODATION IN VERTICAL DIRECTIONS OF GAZE*

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In the past it has been assumed that there is one near point of accommodation and therefore a constant distance from the eye at which near objects are seen clearly, irrespective of the direction of gaze. Because of the close reflex association of accommodation with convergence, it might have been expected that the near point of accommodation would vary in horizontal directions of gaze. Changes of accommodation with the eyes looking up or down were not expected.

Sachs,[1] in 1890, found that, when one looks up at test type and then down at test type of equal distance from the eye, the lower object appears blurred due to what he called unnecessary accommodation. He also stated that Donders found that the hyperope will overaccommodate more than the myope in downward gaze.

PROCEDURE

The left eye of 56 normal pre-presbyopic individuals was occluded and measurements of their near point of accommodation were made on the right eye. The near point was measured in diopters from the anterior focal point of the eye (15 mm.). If the subject normally wore a prescription, it was worn in the test (no hyperopes wearing over plus-one diopter or myopes wearing over minus-two diopters in any meridian were used). The near point of accommodation was measured on a flat piece of paper supported by a board held against the face.

Measurements were taken with the eye adducted and abducted so that a curve of the near point of accommodation of that particular individual could be made. Similar curves were constructed on the paper with the eye looking up 20 degrees, down 20 degrees and down 40 degrees.

Jaeger type-2 print was used for the test object, and it was moved toward the eye until the subject reported blurring. The subjects were reminded to try to keep the print clear and report when an equal amount of blurring occurred for each near point of accommodation measurement.

An additional group of 24 subjects was measured straight ahead and looking up and down using a Prince rule.

The far point of accommodation was measured in 20 of the group of 56 individuals using the paper on the board method. A plus seven lens was placed 13 mm. before the right eye and the test print moved away from the eye until it blurred. Curves were made on the paper at the four vertical settings.

The left eye of 50 normal presbyopic patients (with a mean age of 56 years) was occluded and their near point of accommodation was measured straight ahead with the power of their reading addition placed directly before the distance segment. The near point was again measured looking down through the reading add in the normal reading position (down about 25 degrees and in about five degrees). Jaeger type-2 print was used on a Prince rule. Several measurements were taken at both positions to insure accuracy. Five aphakic individuals were also measured in this way.

RESULTS

The mean of 56 measurements of the near point of accommodation in the horizontal plane is represented in Figure 1 where the board curved line represents what might be called the horizontal near curve of accommodation. The fine line is a curve containing the near point measured straight ahead on which the mean near-point measurements would lie if the near point of accommodation was the same in the horizontal plane.

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Thus accommodation was increased on looking in, while it was less on looking out. Of the 56 subjects, 43 showed this increase on adduction, 13 showed no difference, while three showed a loss of 0.5 diopter of accommodation.

Figure 2 shows a side view of this curve in which the heavy line represents the mean of the near point of accommodation of 80 subjects measured looking up and looking down directly before the eye. The fine line again would represent this curve if the near point were the same in vertical gaze. Accommodation increases even more on looking down than on looking in and decreases on looking up. All 80 subjects showed an increase in accommodation on looking down. On looking up, 63 showed a loss in accommodation, while the rest showed no change.

In Figure 3 the mean near point of accommodation of 56 subjects is diagrammed with the eye directed up and out (up 20 degrees and out 40 degrees) and down and in (down 40 degrees and in 40 degrees). These were the two extreme positions tested and showed the greatest difference in accommodation.

From these figures it can be seen that accommodation changes more in vertical directions of gaze than in horizontal directions and even more in oblique directions. Thus, while accommodation increased about eight percent on looking in 40 degrees, it increased about 20 percent on looking down 40 degrees, and finally 33 percent on looking both in and down 40 degrees.

Accordingly, the near point of accommodation describes a curved surface, concave before the eye, which curves in deeper nasally and below and flattens out above and temporally.

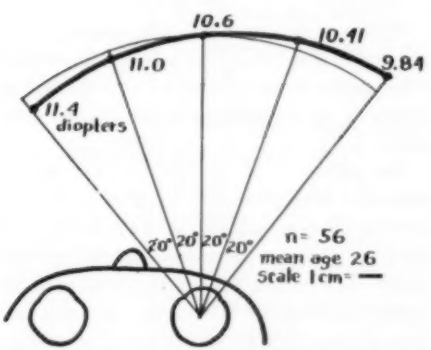

Fig. 1 (Ripple). *The horizontal near curve of accommodation.* The broad, dark line joins the mean monocular near point of accommodation of 56 normal pre-presbyopic individuals in the designated directions of horizontal gaze at the level of the eye. The fine line is of equal distance from the eye.

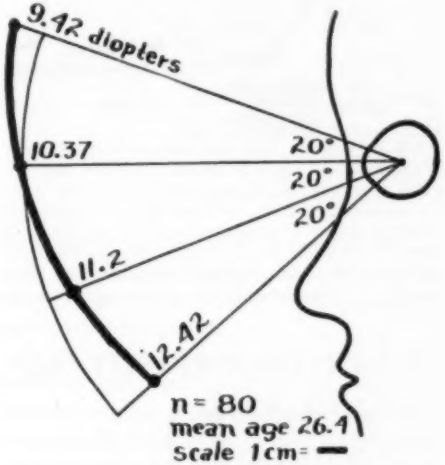

Fig. 2 (Ripple). *The vertical near curve of accommodation.* The broad, dark line joins the mean monocular near point of accommodation of 80 normal pre-presbyopic individuals in the designated directions of vertical gaze in the sagittal plane before the eye. The fine line is of equal distance from the eye.

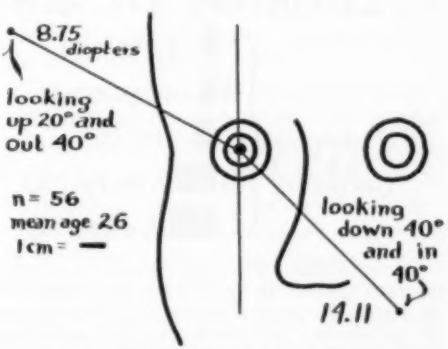

Fig. 3 (Ripple). Comparison of the mean near point of accommodation in the two extreme oblique positions of gaze of 56 normal pre-presbyopic individuals.

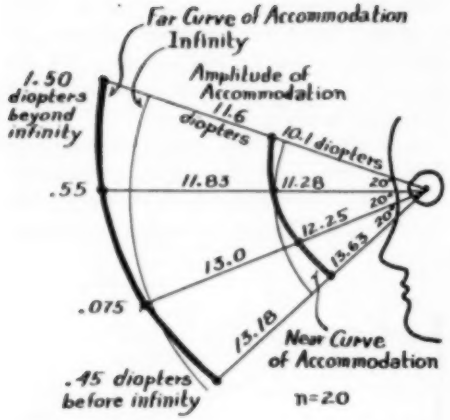

Fig. 4 (Ripple). *The near and far vertical curve of accommodation.* The two dark lines are the mean near point of accommodation and far point of accommodation of 20 normal pre-presbyopic individuals in the designated vertical directions of gaze. The fine lines are of equal distance from the eye (the far curve represents infinity). The mean amplitude of accommodation is recorded between them.

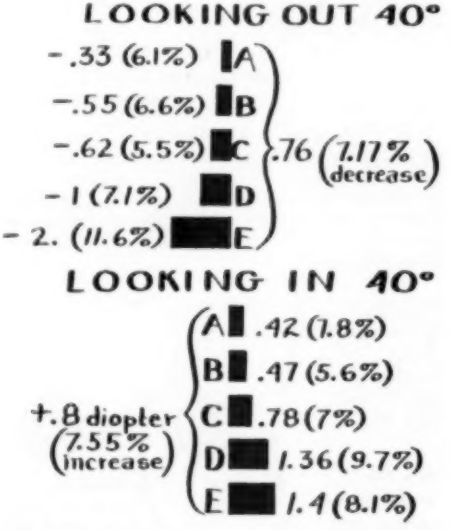

Fig. 5 (Ripple). The mean decrease in accommodation (solid bars to the left) on looking out 40 degrees is compared to the mean increase in accommodation (solid bars to the right) on looking in 40 degrees in the five different groups of pre-presbyopic individuals. Group A contains the younger subjects with the most accommodation, while Group E contains those with the least accommodation.

The 20 subjects who had their far point of accommodation measured in the different directions of gaze demonstrated that a similar phenomenon exists here also. Figure 4 compares the far curve of accommodation with the near curve. The far curve was found to lie beyond infinity above and straight ahead, but curved inside of it on looking down.

There was not as much of a change in the measurements of the far point of accommodation, suggesting that there may be an actual increase in the amplitude of accommodation on looking down as well as a shift of the whole range of accommodation toward the eye. There was some trouble in getting the subjects to relax consistently to the plus seven lens in determining the far point of accommodation so that the suggested increase in amplitude is questionable.

The younger subjects with the best amplitude of accommodation showed the greatest change with direction of gaze, but the percentage of change was about the same for all. To demonstrate this, the subjects were divided into five groups depending on their near point of accommodation measured in the usual position (straight ahead) :

	Diopters	*Subjects*
Group A	4 to 7	11
Group B	7 to 10	27
Group C	10 to 13	22
Group D	13 to 16	13
Group E	16 to 19	7

Figure 5 compares the five groups in the horizontal plane (looking in and out), Figure 6 compares them looking up and down, and Figure 7 in the two extreme oblique positions.

The group of presbyopic subjects demonstrated a mean increase of 25.5 percent in accommodation on looking down in the usual reading position as compared to straight ahead. The younger presbyopes showed the greatest change with change of gaze, and four of the older subjects showed no change. Figure 8 demonstrates this change as plotted against the age.

The five aphakic subjects did not show a change in accommodation on looking down through their additions.

Discussion

These results show that accommodation is a flexible dynamic action closely united with the innervational activity of the entire extraocular muscle system. An increase in accommodation, as demonstrated by these subjects upon looking in and down, is a logical and purposeful phenomenon.

Thus, instead of a static near point of accommodation, the maximum effort of accommodation should be imagined as a curved surface, concave toward the eye which curves more deeply down and in and flattens up and out. From a phylogenetic standpoint it can be imagined that as man began to use his hands in a creative way, there was a greater demand for accommodation in the usual working position (down and in convergence).

In the pre-presbyopic patient this phenomenon has but theoretical interest, but it becomes of practical clinical value in dealing with the presbyopic patient, especially in the early stages when there is still appreciable accommodative power.

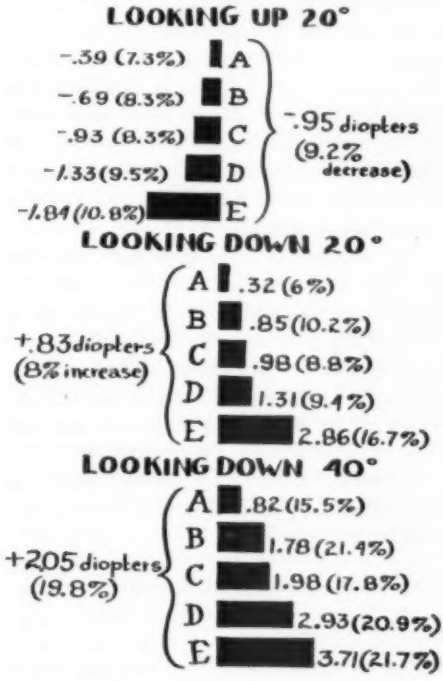

Fig. 6. (Ripple). The mean decrease in accommodation on looking up 20 degrees is compared to the mean increase on looking down 20 and 40 degrees in the five different groups of pre-presbyopic subjects.

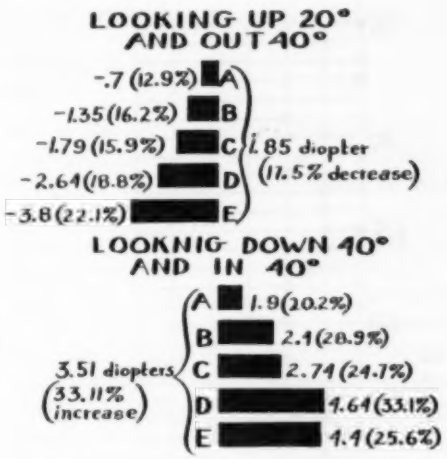

Fig. 7 (Ripple). The five groups are compared in the two extreme oblique positions.

It has been demonstrated that accommodation improves about 25 percent in the reading position. This factor is obviously important in computing the correct addition for near work. Since most of the methods used to compute the reading addition are done so with the eyes straight ahead, this factor is not corrected as such.

This is one reason why the beginner in refraction may prescribe too much plus for the reading add. The skilled refractionist never gives too much plus, but corrects for this factor through experience.

The mechanism of this change in accommodation with direction of gaze can best be explained as a synkinesis with the ocular muscles, or perhaps more specifically with convergence. Certainly the association of accommodation with convergence cannot be denied. Then it must be postulated that convergence tone, or at least the ability to converge, is different looking up and looking down. The position of rest is some evidence for this (the eyes go up and out when convergence tone is relaxed by sleep or anesthesia).

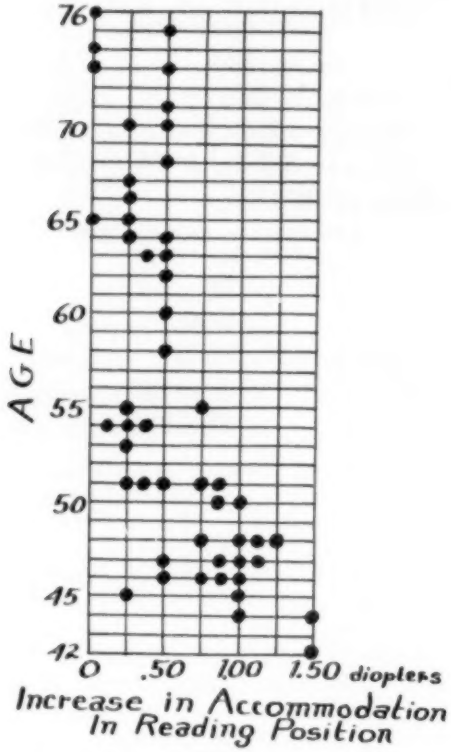

Fig. 8 (Ripple). The increase in accommodation on looking down in the normal reading position (as compared to that straight ahead) is plotted against the age for 50 normal presbyopic subjects wearing their near correction.

Uncrossed diplopia can frequently be relieved by elevated gaze. Rose and Ripple[2] demonstrated a shift to exophoria of about two diopters and an increase in prism divergence with elevated gaze.

Urist[3] in a study of vertical deviations secondary to horizontal deviations noted an increase of esotropia or a decrease in exotropia in depressed gaze, with the opposite in elevated gaze in 174 cases. However, he found the opposite true in 96 cases which would be contradictory.

Convergence (and therefore accommodation) then appears to be increased on looking down and decreased on looking up by either anatomic factors of the orbit and fascia or by innervational tone. If the latter is true, convergence and accommodation are not only related to the horizontal muscles (cranial nerves III and VI), but also to the vertically acting muscles (including the IV cranial nerve).

Summary and Conclusions

Accommodation, as determined by measuring the monocular near point of accommodation, was found to improve when the eye was directed in; more so when down; and even more when directed down and in simultaneously. The opposite was found true for up and out. Thus, instead of a near "point," a near "surface" of accommodation is a truer concept; a curved surface concave toward the eye and curving deeper in and down and flatter up and out. If the term near point of accommodation is used, its direction of measurement should be given. The far point of accommodation was found to exhibit a similar phenomenon.

This increase on looking in and down was also true in presbyopic individuals who increased accommodation about 25 percent in the reading position over the straight forward position. This factor should be considered in computing the correct reading addition if the addition is measured with the eyes straight ahead as it so often is.

A synkinesis with convergence which is in turn affected by vertical gaze is offered as a possible explanation.

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THE FAR EAST AND INDIA THROUGH THE OPHTHALMOSCOPE

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During the first few months of 1952, under the sponsorship of the J. G. Watumull Foundation, and with the assistance of the World Medical Association, I left on a good-will-teaching tour of India. My itinerary included Japan, Thailand, India, Ceylon, Malaya, Australia, New Zealand, and Fiji. In the following paragraphs, I will attempt to describe the principal topics of ophthalmic interest which I encountered during my travels.

JAPAN

The German influence is still strongly evident among the ophthalmic profession of Japan. Eye diseases are often diagnosed according to German nomenclature and operations are frequently scheduled in German. Scientific articles written in Japanese usually have a short German synopsis at the end of the article.

In addressing a group of doctors in Tokyo, whose understanding of English was poor, the only way I could be sure that I was understood was to read a paragraph at a time, wait for the interpreter to translate it, and then go on with the next.

At the Tokyo Medical School, I met Dr. Hogara Hagiwara who recently revised a beautifully illustrated colored atlas of fundus diseases. Dr. Hagiwara is considering the translation of this work into English. In this clinic an active research program is in progress on the histology of the retina.

At the eye department of the Tokyo Medical and Dental University, Dr. Jin Otsuka was experimenting with aniseikonia. His apparatus is considerably less intricate than the equipment used for this purpose in the United States. Dr. Otsuka is a prolific writer and has contributed to the ophthalmic literature on a variety of subjects. His principal interests are changes in the crystalline lens during accommodation; the influence of heredity on refraction; the relationship between visible fundus changes and the total refractive error in myopia, and a score of others.

One of the most thought-provoking and novel operations I've witnessed in all of Japan was an operation for astigmatism by Dr. Tutomu Sato at the Jutendo Medical College. This procedure entailed the application of multiple scratch wounds on both the inner and outer surfaces of the cornea. Its rationale is based on the well-known fact that changes in astigmatism result from even a simple corneal section made during cataract operations.

For vertical astigmatism the exact technique involves the introduction of a modified needle-knife at the 3-o'clock position at the limbus. The knife-needle is then carried across the anterior chamber and five, 3.0- to 4.0-mm. long radial incisions are made at and on either side of the 180-degree meridian through the endothelium, Descemet's membrane, and into the deeper layers of the substantia propria. The knife is then withdrawn without loss of aequeous, reintroduced at the 9-o'clock position and the procedure is repeated on the opposite side.

Upon completion of the intraocular phase of the operation, similarly placed scratch wounds are made with a Bard Parker type of blade into the superficial corneal layers (epithelium, Bowman's and outer surface of the substantia propria). Prior to the operation the exact horizontal meridian is delineated with a single strand of human hair, and the pupil is kept in extreme miosis.

For horizontal astigmatism, the technique remains the same but the wounds are placed surrounding the 90-degree meridian (fig. 1).

I had the good fortune to see several patients who had been operated upon according to this technique. In cases operated several months previously, the eyes were pale, the scratch wounds were visible only as faint

or pronounced linear maculas, and there was no evidence of endothelial dystrophy on slit-lamp examination. According to the records, the amount of astigmatism had often been reduced as much as six to eight diopters.

Dr. Sato is of the opinion that his procedure is of particular merit for aviators and others whose high degrees of astigmatism keep them from following their chosen

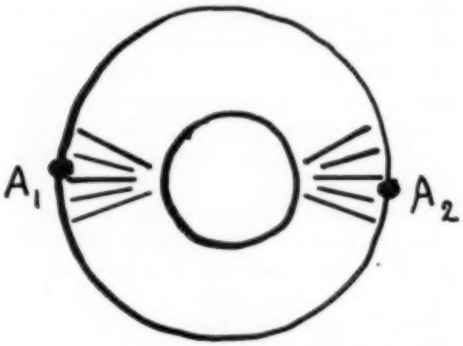

Fig. 1 (Holmes). Sato's operation for horizontal astigmatism. A_1 and A_2 mark the limbal incisions into the anterior chamber.

occupations. He advocates a modified form of this procedure for the relief of high myopia.

At Dr. Sato's clinic I also saw several cases of corneal, scleral, and chorioretinal degenerations which had been successfully treated with Filatov's tissue therapy. At the time of my visit Dr. Sato was using 2.5-inch squares of the patient's own skin which he had refrigerated at 37°C. for several days prior to sewing it back in situ.

In Tokyo, I almost met Miss Ishihara, prominent young ophthalmologist and daughter of Professor Ishihara whose pseudo-isochromatic color charts are known the world over. A revised edition of this atlas has recently been published.

The majority of people in Japan are insured by the National Medical Insurance scheme. The fees paid to private physicians under this system are very low. An average office call costs between $1.00 and $1.50; refractions are 42 cents; a pair of glasses cost $3.00; and, a cataract operation is $6.00.

I spent a full day at the eye hospital of the Drs. Inouye (father and son). Theirs is a 20-bed private hospital, where with the aid of two assistants they treat approximately 200 patients daily. Dr. Inouye, Sr., is the originator of several Snellen type of distance visual acuity and astigmatic charts. One of these, consisting of pictures of well-known animals at decreasing visual angles, has gained wide international recognition and has been reproduced in Berens' *The Eye and Its Diseases.*

Indirect ophthalmoscopy and noncycloplegic retinoscopy is the rule rather than the exception in their clinic and in most of Japan. Dr. Masazumi Inouye called my attention to an unusual form of solar retinitis referred to as B-29 retinitis, seen among Japanese soldiers during the past war. This condition occurred among plane spotters who, with or without binoculars, had to observe and follow the bright shiny bodies of the American B-29 type of aircraft daily for one or more hours over a period of several weeks or months. Clinically these patients complained of blurred central vision. The fundi, in some instances, revealed a loss of foveal light reflex and increased pigment deposition in the region of the macula.

Japanese oculists do not use sutures for their cataract operations. One reason for this is the fact that their patients are usually very coöperative, seldom fuss, and obey instructions. Most patients when told that they need surgery will submit to any procedure recommended by their doctor without hesitation or questioning.

I was told that 10 percent of the patients seen in the eye departments of the Japanese hospitals have trachoma. Though the newer antibiotics, especially terramycin and others, are used with increasing frequency, many surgeons still prefer to scarify the trachoma nodules with a fish file. (fig. 2).

Research on trachoma is actively pursued by Dr. I. Tsutsui, whose valuable observations on the electronmicroscopic appearance of the trachoma virus have greatly con-

tributed to our knowledge of this disease. Dr. Tsutsui's present work involves the examination of metal castings of conjunctival scrapings for inclusion bodies.

Diseases of general medical interest seen commonly in Japan and relatively infrequently in the United States are beriberi, encephalitis Economo, abdominal typhoid, and Tsutsugamutsi fever.

During my short stay in Japan, I saw three premature babies with retrolental fibroplasia, born to families of mixed racial parentage; Japanese mother and Caucasian father. This is of significance particularly because the disease is virtually unknown among Japanese physicians whose hospitals are not equipped with resuscitators, incubators, and the like.

An account of ophthalmology in Japan in the early part of 1952 would not be complete without reference to the magnificient medical and surgical work done by the United States Army of Occupation at the Tokyo Army Hospital. Under the inspiring leadership of Lieut. Col. Forrest Hull, head of the EENT Department, over 5,000 intraocular Korean war injuries have been treated with great dispatch and efficiency. An enviable liaison consisting of lectures, clinics, and discussions of interesting cases has also been established between American and Japanese ophthalmologists.

Thailand

In Bangkok, I visited the Chulalongkorn Hospital operated by the National Red Cross of Thailand. This hospital originally endowed by the royal family is maintained by voluntary contributions of the people. Their wards and the operating rooms are scrupulously clean. They observe strictest aseptic technique, use modern equipment, and provide ample and adequate nursing care. I observed three successful extracapsular lens extractions done under a sliding conjunctival flap with a round pupil, at this hospital.

A short walking distance from this hospital is the Pasteur Institute of Thailand. Here under the direction of Dr. Chaloem Purananda, cobra venom, cholera antitoxin, smallpox vaccine, and other vaccines and sera are prepared and purified.

The Eye Department of the University of Thailand is likewise well equipped and efficient and boasts a very large out-patient department. This university is "sponsored" by Washington University of St. Louis, Missouri. A team of approximately eight to 10

Fig. 2 (Holmes). In Japan many surgeons still prefer to scarify the trachoma nodules with a fish file.

members from the clinical and preclinical departments of the two school are exchanged each year.

Thailand boasts a very active and efficient public-health program. Through their malaria project in the north, they covered 300,000 people last year and will cover 1,000,000 people this year. In the south they are taking active measures for the eradication of filariasis. In the east and south, 16 mobile units tour the country to examine and treat about 100,000 patients a year for yaws. I was told that two injections of procain penicillin are usually sufficient to control the disease and to effect a "cure."

India

According to a report by the Surgeon General of the Government of India, eye diseases rank second among all the diseases that affect the 360,000,000 inhabitants of that country. With a few exceptions, most of these are preventable or amenable to treatment. However, due to poverty, ignorance, superstitions, an attitude of resignation, and large distances to the nearest hospital, only

a small percentage seek medical advice and then often only when the pain becomes unbearable or when blindness has already ensued. This delay is responsible for an assortment of weird and advanced lesions involving the orbits, the ocular adnexas, and the eyes that may be encountered at most large eye centers.

Charlatans and cataract couchers, though fewer in numbers than in the past, still abound and further contribute to the appalling incidence of blindness in India.

The most common eye diseases may be listed under the following headings:

Congenital anomalies

Anophthalmos, microphthalmos, cryptophthalmos, buphthalmos, colobomas of the lids, iris, and optic nerve, congenital cataracts seem more common in India than in Europe or the United States.

The causes of this unduly high percentage of congenital malformations may lie in intermarriages under the caste system, undernourishment, vitamin deficiencies, relative lack of resistance to intercurrent infections during pregnancy, cogenital syphilis, and others. The mortality rate of infants under one year of age is 145 per thousand and that of expectant mothers 20 per thousand.

To my knowledge, at the time of this writing, there is no authentic case of retrolental fibroplasia on record in all of India.

Keratomalacia

Until I arrived in India, I had never seen a case of keratomalacia. By the time I left, I saw several hundred and heard of several thousand more. Keratomalacia is a preventable disease of the eyes due primarily to deficiency of vitamin A in the diet. It is often associated with intestinal worms, and occurs more frequently in infants with severe diarrhea.

Night blindness is a common symptom. Clinically, in the early stages, silvery, gray plaques may be noted in the interpalpebral portions of the bulbar conjunctivas. Later, an abrasion of the cornea will develop, followed by ulceration and eventual perforation of one or both globes. The end result is a blind eye with corneal leukoma with or without an anterior staphyloma.

Col. Sir J. N. Duggan, D.O., dean of Bombay ophthalmologists, offers the following explanation for the train of events that lead to keratomalacia:

"It (keratomalacia) is more common among children of mill hands and laborers. The lot of a female laborer is pitiable. She has to nurse her child in her leisure hours and devote most of her time in earning her livelihood, in company with her husband or separately. She cannot look after both these duties with equal efficiency.

"There is a custom among these mothers to give the child a pill consisting of opium, bhang, and some flavoring agent, commonly called 'Bal-goli,' after the first morning feed, and thus, put the baby to sleep so that they can attend to their work outside without any hindrance. The child thus passes the whole day in sleep, during which time it hardly gets any milk or food. In the night, the tired mother is longing for her rest which she must take to feel refreshed in the morning to undertake her daily duties.

"The child is thus neglected; the milk it gets is of a poor quality and insufficient in quantity; its digestion is moreover upset by the daily administration of the 'Bal-goli.' The child is deprived of sunlight, fresh air, and fresh milk. The daily dose of opium completely breaks down its power of digestion so that it cannot even digest whatever little nourishment it gets every day. Its growth is arrested, the child becomes irritable and fretful, and the tissues begin to waste. It becomes marasmic and suffers from diarrhea and rapidly develops signs and symptoms of keratomalacia."

Smallpox

This preventable, highly contagious disease is responsible for a large percentage of dense, unilateral or bilateral corneal scars,

associated with some degree of facial disfigurement. Although notification is compulsory, cases are often not reported for fear that the patient may be isolated. Unless compulsory vaccination and revaccination every seven years and during epidemics will be vigorously enforced, this disease will continue to be responsible for many thousands of cases of needlessly blind people.

Tuberculosis, syphilis, and leprosy

In the eye wards of most general hospitals, one or more manifestations of all three of these diseases may be seen.

According to recent statistics, there are approximately 2,500,000 cases of tuberculosis in India with an annual death rate of 500,000. The 10,400 beds earmarked for this disease are obviously grossly inadequate. It is hoped, however that the recently inaugurated vigorous BCG vaccination campaign will materially reduce the number of new cases in the future.

Tuberculous phlyctenular keratitis, episcleritis, iritis, and choroiditis are quite common. Topical, subconjunctival, and systemic streptomycin is proving an effective weapon in the management of these cases and at least in the case of phlyctenular disease it is slowly replacing the use of such standbys as calomel dusting powder. Para-amino-salycilic acid is widely used as an adjunct in tuberculosis therapy.

Luetic interstitial keratitis and chorioretinitis are also rather common.

Lepromas of the cornea occur in a high percentage of patients afflicted with leprosy. In some institutions, these lepromatous masses are resected and an optical iridectomy is performed.

In the systemic treatment of leprosy, the sulfones are used fairly extensively. Multiple intracutaneous injections of chalmoogra oil have, however, by no means been completely abandoned.

Trachoma

Trachoma, though somewhat on the wane, is still almost universal in India. It affects both the rich and the poor and is responsible for a large percentage of blindness.

Several means for its spread have been postulated. Infection through direct contact with contaminated napkins, handkerchiefs, sarees, bed sheets are probably the most common means of spreading this disease. The widely practiced Indian superstition of anointing children's and adult's eyes with "surma" is another likely means of spread. This practice consists of applying an oily, black preparation containing antimony, camphor soot, and olive oil to the lids by means of a glass rod.

As the same glass rod is used for many applications, infection may well be transmitted with it from person to person. Thus, the very method designed to keep evil spirits away and to afford protection from disease is in part responsible for the transference of trachomatous infection.

Still another theory (Cuenod-Nataf) attributes the transmission of trachoma to body lice and/or flies.

A person with trachoma after rubbing his eyes may scratch a louse infected portion of his body and deposit there a thin film of trachomatous discharge. From these areas, lice are suspected of transmitting the virus to another person's body, who in turn will scratch his skin and later transfer the infection to his eyes and thus complete the cycle.

Dr. S. N. Cooper of Bombay is of the opinion that trachoma is more likely to occur among patients afflicted with tuberculosis than in healthy subjects. Immunologically, he has been able to show that when the two diseases coexist, therapeutic responses are more prompt and effective in patients placed on a desensitizing regime to old tuberculin, than in a corresponding control group.

All phases and stages of trachoma are present in India. The commonest surgical lesions are ectropion of the upper and lower lids. An effective operation of trachomatous entropion involving the upper lid is one which utilizes oral mucous membrane, transplanted to the denuded lid margins.

The medical treatment for trachoma varies with localities. Local applications of one- to two-percent silver nitrate are probably the most widely used. The copper sulfate stick is by no means extinct. Sulfa preparations, aureomycin, and other newer antibiotics also have their advocates. The comparatively high cost of these drugs is the main stumbling block to their more widespread adoption. An additional objection to the routine use of oral sulfa preparations in India and elsewhere in the tropics is due to the fact that people perspire excessively without replenishing their fluid balance. Thus, dangerously high concentrations of sulfa crystals may appear in the urine.

Dacryocystitis

For every case of purulent dacryocystitis in the United States, there must be at least 30 or more in India. I know of no good explanation for this high incidence, unless chronic conjunctivitis and lack of bodily resistance to chronic infection may play a role. The routine treatment consists of simple removal of the sac. It is not at all uncommon to see four or five young surgeons operating on as many patients with chronic tear-sac infections in the same operating theater at the same time. In a few of the bigger centers a few surgeons are doing the dacryocystorhinostmy operation.

Corneal leukoma and anterior staphyloma

Keratomalacia, smallpox, syphilis, tuberculosis, ophthalmia neonatorum, foreign bodies, and ulcers of the cornea materially contribute to the extremely high incidence of corneal opacities and anterior staphyloma.

Foreign bodies of the conjunctiva or cornea and severe cases of conjunctivitis are of greater significance in India than elsewhere, as many of them are seldom attended in the early stages. When they are finally seen by a physician, perforation of the globe may be imminent or has already taken place.

Other factors responsible for these dire sequelas of simple corneal lesions are the frequent coexistence of chronic purulent dacryocystitis, poor nutritional status, severe avitaminosis, apathy, ignorance, and poverty.

The resulting corneal scars and staphylomas assume sizes and proportions with corresponding degrees of cosmetic deformity. The active treatment of these lesions is limited. A few surgeons will attempt tattooing of the cornea. Others favor a staphylotomy. This operation amounts to a partial evisceration with most of the cornea, the lens, and some of the vitreous being removed and the wound closed with corneoscleral sutures and covered with a conjunctival flap. This procedure enables the patient to keep his eye and wear a prosthesis over the stump with a fair degree of mobility. Most surgeons, however, recommend enucleation as the method of choice for large, bulging, unsightly eyes.

The potentials of corneal transplantation for this large group of patients afflicted with corneal opacities are great and have hardly been explored. It seems to me that with the advent of beta-ray therapy, corneal transplantation holds a fair degree of promise for the restoration of sight to countless numbers of blind all over India.

Glaucoma

Acute episodes of glaucoma as well as various chronic forms of glaucoma are rather common among the Indian race. Elliot's trephining operation and, more recently, iridencleisis are the operations preferred by most eye surgeons. A special type of glaucoma, known as epidemic dropsy glaucoma and found only in India, has been described by Major Dutt of Calcutta as follows:

"This disease is caused by a toxin of an alkaloid isolated from argemon seed oil which is used to adulterate mustard oil. It is associated with edema of the legs, dyspnea, tachycardia, and cardiac dilatation. The ocular signs and symptoms are absence of pain, presence of persistent rainbow halos, intermittent periods of severe bilateral blurring of vision, little loss of field in spite of a very

high tension (from 50 to 100 millimeters), a deep or normal anterior chamber, and a normal pupil. A suitably performed filtering operation usually results in cure. Miotics, however, are usually of no avail."

Cataract

Wherever I went in India, I asked the question, "Why do so many—approximately one out of every hundred—residents of India get cataracts?"

I was told what I already knew: "That the intensive heat and glare of the sun were mainly, and that hereditary factors were partly, responsible."

Nevertheless, with very few exceptions, most people in India use no protection whatever to shield their head or eyes against the sun. From this standpoint, it is unfortunate that customs dictate the use of a turban instead of a sun helmet and that the price of even the cheapest tinted lenses is out of reach for the average person.

As the incidence of cataract is equally distributed among vegetarians and meat eaters, it would seem that protein deficiency per se is not the cause.

Granted that both radiant energy and heat are known cataractogenic agents, it would appear that they are not solely responsible and that other factors are likely to be at play. Of these protein, vitamin, and mineral deficiencies must be of particular significance in a country where food shortages have existed for generations.

Toxic agents ingested in the form of impurities in the diet or in drugs, inhaled in the form of carbon monoxide or other noxious fumes during cooking with inferior fuel, may be further contributory factors.

Long hours of extremely exacting work such as sewing, and wood, marble, and ivory carving, hand embroidery, silversmith operations, and other similar intricate occupations, with uncorrected errors of refraction, at levels of illumination that range from intense sunlight to the flicker of a candle, may also contribute to the high incidence of eye diseases which terminate in lens opacities.

It would seem that only through coördinated, intensive, on-the-spot research, embracing the fields of physics, biochemistry, physiology, pharmacology, toxicology, endocrinology, and others, will the etiology of cataracts in India be clarified.

It is my understanding that each year approvimately 100,000 cataract operations are performed in India. If each patient with operable cataract has his lens removed, this figure would climb to around 500,000 operations a year. On the basis of these figures, it is small wonder that the Indian ophthalmologist is the best cataract surgeon in the world. During "cataract season," which in most areas occurs from October to March, in the eye wards of most general hospitals 20 to 30 or more cataract operations are performed daily! In the villages where mobile surgical ophthalmic units call from time to time, these figures are a great deal higher.

In conjunction with such a trip to one of the remote villages, between the hours of 8 a.m. to 5 p.m., I personally performed 27 lens extractions, along with several iridectomies and other minor procedures. More experienced surgeons can and have, in fact, done two to three times this number.

The technique favored by most Indian surgeons is extracapsular extraction under a conjunctival flap. The operation is always performed under local anesthesia, using the O'Brien type of akinesia, with or without retrobulbar injection.

As a rule no sutures are used. However, I have seen a few surgeons, especially in Bombay, use conjunctival and at times even corneal sutures. They always make their incision with a Graefe knife and never with the keratome. In fact, the keratome is hardly known in India; most iridectomies and Lagrange sclerectomies are done with the Graefe knife.

Most surgeons do not irrigate the anterior chamber following extraction of the lens even though it may contain considerable cortical material and anterior lens capsular

remnants. Their aversion to this procedure probably stems from the fact that irrigating solutions may be contaminated. They, therefore, feel safer to leave some cortical material behind rather than take a chance on introducing infection into the interior of the eye.

The intracapsular operation with a small peripheral iridectomy also has its advocates. Those who practice it deliver the lens with the same high degree of dexterity that they exhibit in extracapsular maneuvers. At the end of the operation many surgeons use 25,000 to 50,000 units of aqueous penicillin, subconjunctivally. It seems reasonable that this factor is largely responsible for the virtual absence of postoperative infection following cataract extractions. Eyes that were so treated show practically no discharge at the first postoperative dressing, two to three days after surgery.

Following surgery, the patient may either walk or be carried in a sitting or prone position back to his bed or to his place on the floor, if the available beds are all occupied.

Bilateral extractions are rountinely performed in some, though not all, clinics. This is often done for a good reason. When one realizes that patients often travel long distances, sometimes on foot, to the eye hospital and that few of them will ever be in a position to undertake a second trip, or, in cases of a traveling clinic, that the mobile unit will not again call in the same village during the patient's lifetime, and that bed or even floor space is always a great premium, bilateral operations at the same sitting seem justified.

A concession made in some instances is for one surgeon to operate on one eye of a patient and for another surgeon to take over on the second eye. In spite of what often appear to be primitive conditions, especially at the village eye camps, the end results on the whole are surprisingly good.

The chief complication that plagues surgeons using the extracapsular technique is iritis phaco-anaphylactica. Whether these cases of lingering postoperative iritis are due entirely to retained cortex or whether they are the result of dental or other associated sepsis still remains to be determined. However, researches in progress seem to indicate that both capsular and cortical extracts are capable of producing severe skin reactions, and that in the desensitization process they may both have to be taken into consideration.

Strabismus

Surgery on the extraocular muscles is very uncommon in India. At one busy clinic where over 3,000 cataract operations were performed in a year, only seven cases of muscle surgery were listed for the same period. When one day I scheduled an advancement and resection of an external rectus with recession of the internal rectus and recession of the inferior oblique, I had more interested observers than could be accommodated in the theater in which I was working.

Some of the reasons for the scarcity of squint cases are:

1. According to popular superstition in India, it is considered lucky to possess a squint; though some people feel that meeting a man with a crossed eye may bring one bad luck for the rest of the day.

2. The Indian is satisfied with his own appearance. If he was born with a squint or other cosmetic defect, "that was the way it was written" and in his own mind he is satisfied to leave well enough alone.

3. A large percentage of marriages are still entered into according to the old system. The parents make all arrangements and the prospective bride and groom do not see each other until after they are married; thus, a girl with a squint has as good a chance to get married as her sister with normal eye muscle balance.

4. Under the system of purda, still adhered to by many millions of inhabitants, women do not show their faces in public. When these women walk on the street, they are heavily veiled from head to foot save for a tiny slit over their eyes. This affords a perfect physical and psychologic escape

mechanism for those who have something to hide. On several occasions while making rounds in other than the eye wards of various hospitals, I noted that women patients instinctively turned away rather than run the risk of having me see their faces.

Injuries

As I have mentioned previously, even trifling corneal injuries are potentially dangerous because of the dire consequences which may follow. Perforating wounds of the globe caused by being gored by a bull's horn constitute a fair share of infected and serious eye wounds. During my stay, I saw several such wounds, one to 10 days old, including a case of sympathetic ophthalmia brought on by such an injury.

Multiple sclerosis

Multiple sclerosis is an unknown disease in India and in most tropical countries. No one I talked to has been able to give me a satisfactory explanation for this.

Eclipse blindness

Fortunately, solar eclipses occur only once in 24 years. Were they to take place with greater frequency, they would probably cause more eclipse blindness in India and elsewhere in the world than they do now. In the latter part of February, 1952, the day the solar eclipse took place, I was on my way from Old Delhi to New Delhi. A tremendous crowd, numbering tens of thousands of people, was surging toward the river to bathe and to view the eclipse. By doing so, according to local superstition, they would enjoy good health, good luck, and those in need would receive alms.

From a strictly ophthalmic standpoint, viewing the eclipse with unshielded eyes caused many of these worshippers to present themselves a few days later with typical complaints and findings of eclipse blindness at the various eye clinics where I visited.

Hospitals

In India, most anyone in need of an operation may be admitted to a government hospital and be operated on at no cost. Social service, the way we know it, does not exist.

The hospital wards are large, clean, airy, and on the average have facilities for 12 to 14 patients. There are smaller six-bed wards where patients have to pay about 60 cents a day for room, board, medicines, dressings, and so forth. A few private rooms are also available at a cost of about $1.20 per day. Each hospital has completely separate wards and operating rooms for septic and clean cases.

On the day of surgery, all patients scheduled for operation await their turn in a large anteroom adjoining the operating theater. There, they sit on the floor, women on one side, men on the other. As a rule, each operating room is equipped with three tables. As the surgeon is finished with one case, he walks to the next which the assistant has already prepared for him. By the time he has completed the second case, his assistant has the third case ready and the nurses have another patient occupying the first table. Thus, with good team work, one surgeon, using one operating room, can operate on a large number of patients in a single session.

The majority of surgeons have a small (six to 30 bed) private nursing home in conjunction with their offices. Persons who have the means to afford private care may be admitted to these homes. There they may choose between private, semiprivate, or ward type of accommodations. Nursing care may be included at some of these homes, but more often patients are cared for, with food brought in from the outside, by their own relatives.

Research

Ophthalmic research in India is hampered by lack of private or public funds earmarked specially for eye work, and by the fact that most ophthalmologists have very little time to devote to it. At the larger centers, the leading ophthalmologists spend the major part of each day at municipal or other gov-

ernment hospitals serving for the most part in an honorary capacity or for a small token fee. This leaves their late afternoons and evenings free to earn their livelihood in private practice. Physicians without clinic affiliations are overworked and find little or no time for original investigation.

The new Institute of Ophthalmology at Aligarh, when completed, is slated to become the focal point for ophthalmic research and may change this picture. In the meantime, some research is in progress at a few centers.

Dr. S. N. Cooper of Bombay is investigating the role of desensitizing agents in iritis phaco-anaphylactica. He is also interested in sensitivity responses in ocular tuberculosis. Dr. Chitnis of Bombay is pioneering in methods of sight conservation and prevention of blindness.

Dr. G. S. Pendse of the Indian Council of Medical Research at Poona has been working on "Total refraction as related to body growth and nutrition." A preliminary report of his work was published in the *Archives of Ophthalmology*, 1951. Dr. D. S. Chaudhoory of Agra, an anatomist, is investigating the embryologic and histologic structure of the extraocular muscles.

Dr. L. W. Chacko of Vellore, also a professor of anatomy, is continuing her well-known, valuable basic studies on the lateral geniculate body. She is also studying the effects of continuous stimulation by red lights on the retina of monkeys. Dr. Chacko is anxious to do histologic examinations on eyes removed from patients who had been color blind. She would be very grateful if such eyes were sent to her.

Quackery

Notwithstanding the medical advances of the 20th century, the practice of cataract "couching" is still prevalent in India. The coucher plies his trade not only among the ignorant village folks, but also on the side streets of big cities. According to Colonel Duggan: "The quack's tongue is very sweet and his speech voluminous and incessant. He has a knack of satisfying even the skeptics and even the educated have not escaped from his clutches. His strange remedies and operations have written permanent history over the eyes of thousands of his victims."

The technique of couching is often handed down from father to son. It consists of an incision near the limbus with an instrument resembling the oblique half of a razor blade. Through this incision, a small unsterilized hook is inserted and the lens depressed into the vitreous. By a sleight-of-hand movement for the benefit of the patient's family, the coucher then produces a bit of egg white and exhibits it as the "removed cataract."

He may finish by selling the patient a pair of +10.0D. sph. before he collects his fee and disappears. It is impossible to estimate the number of eyes that are lost yearly as the result of this contaminated and brutal procedure. I have, however, seen a few patients here and there whose cataracts had been couched and who still enjoyed reasonably good vision.

Prevention of blindness and work with the blind

There are two million known blind in India. This constitutes one fifth of the total blind population of the world. Nearly 90 percent of this total is preventable and another five percent is curable; 30 percent of the blind in India lost their sight under the age of 21 years; most of them during the first five years of life.

The four major diseases causing blindness —smallpox, keratomalacia, ophthalmia neonatorum, and the aftermath of neglected and ill-treated conjunctivities—are entirely preventable and have virtually been eliminated as factors responsible for blindness in the Western world.

For the 2,000,000 blind in India, there are only 32 schools accommodating 1,212 blind children. This means that only 0.6 percent of the total blind population gets the benefit of some form of education. The rest for the most part have to turn to begging to live.

In order to improve existing conditions, the First All-India Conference for the Blind met in Bombay in January, 1952. This body adopted a number of resolutions which, when put into practice, will go a long way toward improving existing conditions.

The principal resolutions include the establishment of a standard definition of blindness; the institution of compulsory registration of the blind; measures to take immediate steps for the prevention of blindness by propaganda against the malpractices of quacks; provision for mobile ophthalmic units for the villages of the principal districts; provision of free and compulsory education of blind children; provision of employment for the blind wherever possible; the establishment of sheltered workshops for the blind; measures to induce governmental agencies to purchase goods manufactured at the various blind schools; the procurement of special materials, apparatus, and appliances including talking books and radios; requests to local governments to provide necessary funds for the prevention and cure of blindness; and the education, employment, and welfare of the blind.

Graduate and postgraduate facilities

Adequate physical facilities for postgraduate ophthalmic instruction exist at several large institutions. These include: The Eye Infirmary, Medical College Hospitals, Calcutta; the R. G. Kar Medical College, Calcutta; the Sir C. J. Hall Ophthalmic Hospital, Bombay; the Government Ophthalmic Hospital, Madras, and many others of equally high caliber.

The Government Ophthalmic Hospital at Madras is associated with the names of such world-renowned ophthalmologic personalities as Lieut. Col. Robert Henry Elliot, Lieut. Col. Henry Kirkpatrick, and Lieut. Col. R. E. Wright.

At this hospital, I was very much impressed with the priceless collection of mounted pathologic and histologic sections, wax, clay, and plastic anatomic models, stereoscopic fundus drawings, and numerous other aids to modern ophthalmic teaching.

The clinical material is plentiful anywhere in India. At the out-patient department of the Government Ophthalmic Hospital in Madras, 150 to 200 new patients and 250 follow-up patients are seen daily. This hospital has 170 beds with an authorized maximum capacity of 302 in-patients. Their average census is in the vicinity of 500 patients.

The chain of command at large university hospitals include several professors, honorary senior and junior house surgeons, resident house surgeons, clinical assistants, and medical students. Though these institutions are usually overcrowded and their surgical schedule is very heavy, they have a correspondingly large staff to do the work. In smaller towns, the numerical strength of the staff is often lower, but opportunities for those interested only in postgraduate surgical experience are neverthless limited.

For foreign visitors, food and lodging constitute additional major obstacles. The former is usually too highly seasoned for the American palate and may often be prepared in accordance with standards of sanitation that differ from those customary among Western people. The latter, especially in smaller communities, is most often not available unless one takes advantage of the gracious hospitality of an Indian family and adapts himself to their ways of living. In either instance, foreign applicants need permission from the Indian Government before they may work in municipal or government hospitals.

The food and lodging in mission hospitals are comparable to average American standards. However, missionary physicians carry on their errands of mercy with a deep sense of spiritual conviction and it is highly desirable that even temporary members of the staff be imbued with similar motives. Therefore, unless an applicant possesses genuine religious leanings and unless he is prepared to share the spiritual, as well as the medical

experiences of the attending staff, he may not "fit in" with the others.

As I stated previously, most ophthalmic surgeons in India, irrespective of their hospital affiliation, are overworked. This leaves them little time to instruct other than their own residents in the principles and techniques of eye surgery.

In my opinion, therefore, only ophthalmologists certified by the American Board, with a thorough foundation in ophthalmology, a reasonable dexterity in ocular surgery, and a willingness and ability to teach, should apply for temporary positions in India with the view of gaining additional surgical experience.

Upon inquiring into the nature of these lesions, I learned that they followed malicious throwing of sulfuric acid. Political differences of opinion, unsuccessful love affairs, jealousy, and similar motives were usually behind this form of revenge.

Mr. Williamson stated that they had had approximately 15 such cases with eye involvement during the past 15 months. On his instigation, all Singapore police and ambulance cars are now equipped with a gallon jar of 10-percent sodium bicarbonate and a large syringe to be used on the scene as a first-aid measure in acid burns.

Superficial punctate keratitis is still endemic in most parts of Indonesia and

Fig. 3 (Holmes). A sign in Singapore.

Singapore

In Singapore, I visited the eye department of the General Hospital, headed by Mr. A. D. Williamson. The wards, operating rooms, and teaching facilities of this hospital were as clean, modern, and up to date as any city hospital of comparable size in the United States. Their teaching facilities were adequate and were in the capable hands of Mr. Williamson's wife, herself a competent ophthalmologist.

In walking through the eye wards, I noted several cases of severe, deforming, and blinding eye injuries associated with massive and extensive keloids elsewhere on the body. Malaya. The treatment used for this disease in Singapore is oral chloromycetin, intravenous foreign protein, and topical dionin.

Keratomalacia in Singapore, according to Mr. Williamson, is frequently the result of feeding children with condensed, sweet milk devoid of vitamin A. During the Japanese occupation of Singapore, when this commodity was unobtainable, no new cases of keratomalacia were observed. After the Japanese left and condensed milk again became available, keratomalacia reappeared.

Charlatans and quacks may be found in all large cities and Singapore is no exception. Figure 3 graphically depicts the window

display of one of these healers and speaks for itself.

Ceylon

In Colombo, I visited the Victoria Memorial Eye Hospital. This institution has a bed capacity of 128 patients. At the time of my visit, the hospital census was 480. Their annual out-patient load numbers approximately 70,000.

In Colombo, as elsewhere in the Far East, aberrant forms of epidemic superficial punctate keratitis are very common. The Ceylon variety, known as keratitis superficialis tropica, is usually unilateral and consists of 10 to 12 central or diffusely spaced, rounded subepithelial infiltrates measuring one to two millimeters in diameter. These often take six months or longer to disappear. Local applications of ether, dionin, (1.0 to 10 percent), and exposure to ultraviolet lights were the treatments of choice, at the time of my visit, for this disease.

Another fairly common group of eye conditions in Ceylon are macular degenerations of undetermined etiology.

At the Victoria Memorial Eye Hospital, I had the good fortune to observe several cases of successful corneal transplantations by Dr. Andre Fesus in patients with keratomalacia.

Australia and New Zealand

From Indonesia and Malaya, I returned to Hawaii by way of Australia and New Zealand. In both of these countries, I found that the practice of ophthalmology was on a par with that of most clinics and hospitals in the United States and on the Continent.

1013 Bishop Street (13).

BILATERAL RETINOBLASTOMA IN A PREMATURE INFANT*

Report of a case

Ivan E. Hix, Jr., M.D., and Ralph W. Danielson, M.D.
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The common occurrence of a great variety of pseudoretinoblastomas has led many authors to cite circumstances in which their diagnoses were confused with retinoblastoma. Reese[1] described an unrecognized retinoblastoma in a case of phthisis bulbi, as well as several diagnoses of retinoblastoma which proved to be old metastatic endophthalmitis or remains of tunica vasculosa lentis.

Bedell[2] describes the cardinal sign of retinoblastoma, a yellowish pupillary reflex, as having been caused by retrolental fibroplasia, angioma of the retina, "leukosarcoma," and Coats's disease.

Theobald[3] mentions occasions when retinoblastomas were diagnosed as retinal cyst and hypopyon. Ellett[4] tells of retinoblastoma misdiagnosed as contusion hemorrhage. Blaauw,[5] in a general discussion of the diagnosis of intraocular tumors, mentions the possible resemblance of iritis and glioma metastases of the anterior chamber.

Reese,[6] in *Tumors of the Eye,* states the differential diagnosis to be retrolental fibroplasia, persistent hyperplastic primary vitreous, metastatic retinitis, Coats's disease, massive retinal fibrosis in children, and medulated nerve fibers.

It is understandable then, in view of the occasional difficulty in differential diagnosis and the tragic results of not removing a malignant growth, that the tendency has previously been to enucleate in questionable cases. However, the apparent increase in the

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incidence of pseudogliomas due to retrolental fibroplasia and the critical descriptions of these and other pseudotumors by Terry,[7] Owens and Owens,[8] and Reese have tended to swing the pendulum in the other direction, with the result that few children's eyes are now removed for "suspicion of malignancy."

So few are the pseudogliomas now found in specimens sent to this hospital for pathologic study that it is again to be feared that a definite malignancy might be misdiagnosed. This has been demonstrated to us when a child developed retinoblastomas while in the Premature Center of our own hospital.

We consider the case unusual enough to report for: (1) It occurred in a premature infant who, since he exhibited symptoms of what was then considered the early stages of retrolental fibroplasia, received a course of cortisone; (2) the tumors were observed from their earliest clinical onset.

Case report

P. R., a white male infant, was born on September 17, 1950, (period of prematurity uncertain). The weight on admission to the Premature Center the same day was 1,750 gm. (3 lb., 14 oz.). Except for prematurity and mild cyanosis there were no evident physical defects. During his hospitalization his general course was uneventful except for a mild upper respiratory infection on October 13, 1950. He received no vitamin-E therapy. He remained in an environment of copious oxygen (50 to 60 percent) for the first few weeks of his hospitalization, this being discontinued October 3rd.

October 10, 1950. The first ophthalmoscopic examination was done at 23 days after birth. The infant weighed 2,060 gm. at this time.

The pupils were dilated with a half-and-half mixture of homatropine (one percent) and paredrine (one percent), followed in 30 minutes by a drop of 10-percent neosynephrine. The infant was held prone by a nurse and the examination was conducted with the infant's head toward the examiner. A rubber nipple containing glucose solution in cotton was used as a pacifier.

This routine was followed on all subsequent examinations, and it is felt that an adequate view of the fundus was obtained each time. At no time was there difficulty in opening the pupils as is sometimes found in retrolental fibroplasia.

The initial examination showed the media to be clear, and they remained so on all subsequent examinations. The retinal vessels showed some dilatation of the inferior-temporal vein in the right eye. The rest of the vessels appeared quite normal.

October 24, 1950. The infant's weight was 2,520 gm. The veins showed approximately the same amount of dilatation as on the previous examination but, in addition, there was some generalized tortuosity of both arteries and veins. A questionable small area of vessel arborization was seen along the superior temporal vein in the right eye. A few punctate hemorrhages were present along this vessel farther peripherally.

November 1, 1950. On the basis of the change in the vascular picture, plus the high incidence of retrolental fibroplasia in the nursery at this time, a diagnosis of probable retrolental fibroplasia was made, and the infant was started on cortisone (25 mg., intramuscularly daily).

November 7, 1950. Weight—2,950 gm. There were moderate distention of the veins and moderate arterial tortuosity in each eye.

November 14, 1950. The right eye showed slightly less venous dilatation and arterial tortuosity than the previous week. There was a flat hemorrhage along the superior nasal vessels. The left eye showed more dilatation and tortuosity of the vessels than the right eye, being about the same as the previous week.

There was noticed for the first time a slightly grayish, edematous appearance of the macular region which appeared slightly elevated, but not measurably so. This area was about one-half disc diameter across, but poorly outlined. The remainder of the

fundus, including the peripheral regions, appeared normal.

November 17, 1950. Cortone therapy was completed.

November 21, 1950. Weight—3,450 gm. The vessels showed moderate venous dilatation and a small degree of tortuosity of the arteries. There were no hemorrhages seen in either eye. The peripheries were clear.

The edematous appearance of the macular area of the left eye persisted and continued to appear elevated. There was little appreciable change in the size and contour of this area, in the center of which a very small opaque spot was seen. This was almost pinpoint in size and was a definite grayish-white in color.

November 29, 1950. Weight—3,860 gm. The retinal veins were slightly tortuous. Dilatation of the veins had become less. The retinal arteries now appeared within normal limits. The macular area in the left eye showed no appreciable change.

There was noted a similar grayish, slightly raised edematous-appearing area immediately lateral to the optic disc in the right eye. This area did not contain any opaque white spots. At this time retinoblastoma was considered as a possible diagnosis.

December 5, 1950. Weight—4,100 gm. The right eye showed the juxtapapillary area to be larger than the week before. It still presented a transparent, slightly grayish appearance quite similar to edema. There were no opaque areas in it.

The left eye showed definite increase in the diameter of the macular mass, and it appeared to be more elevated. The mass itself continued to be almost transparent and of a slightly grayish color. The central, white, opaque spot was more irregular in outline and could be seen to be embedded in transparent tissue. In this transparent tissue there were a few fine blood vessels.

The impression was now that this was probable retinoblastoma, but that the small size of the lesions should justify postponement of enucleation until they assumed a more characteristic appearance.

December 12, 1950. Weight—4,350 gm. The right eye showed the juxtapapillary mass to be well circumscribed, two diopters elevated, and two disc diameters across. It still appeared to be composed of transparent tissue, but it was becoming more gray in color. In it were many fine new vessels.

When examined with the slitbeam of a Friedenwald ophthalmoscope, the tissue immediately surrounding these fine vessels appeared to be slightly denser, forming a "sleeve" along them. There were no dense white areas in any part of this mass, as could be seen in the other eye. No other abnormalities of the fundus could be seen.

The left eye showed the macular area of elevation to be larger than the week before. It was not so well circumscribed. There were similar fine new blood vessels in it. The central dense white material was larger and appeared to be rather lobulated; otherwise this fundus appeared normal.

December 14, 1950. The infant was discharged from the hospital to be seen as an out-patient. In spite of precautions to assure adequate follow-up, he was not seen again until:

January 15, 1951. Weight-11 lb. There was noted a marked change in the appearance of the masses in both eyes.

The right eye showed the mass to be elevated about 12 diopters. This mass was now quite opaque and grayish white in color. It protruded forward into the vitreous and assumed a mushroom shape, obscuring its base and all but the nasal portion of the optic disc. Numerous small vessels could be seen on the surface of the mass.

The left eye showed an elevation of the macular region to eight diopters. Its general appearance was similar to that of the right eye, except that the previously seen whitish, denser material could still be faintly seen within the depths of the mass. This mass did not extend to the disc.

January 19, 1951. The patient was again seen and consultation held. A unanimous

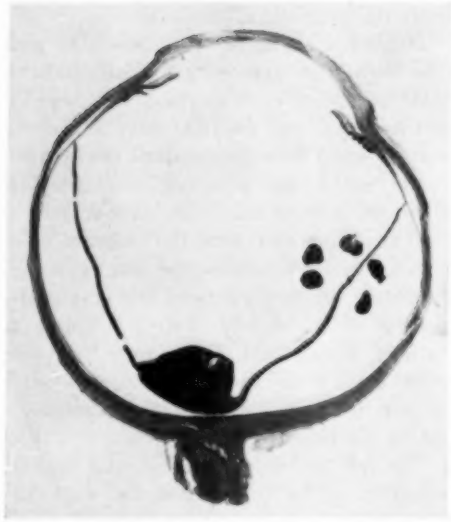

Fig. 1 (Hix and Danielson). Low-power photomicrograph showing the size of the tumor. A portion of the retina is surrounded by five ink spots to localize the second small tumor (separate focus).

diagnosis of retinoblastoma was made, and enucleation of the right eye was advised. In the intervening four days, since the last examination, the tumor in the right eye had increased so as to obscure the optic disc completely.

January 31, 1951. The right eye was removed, with as much of the optic nerve as could be severed. Recovery from the surgery was uneventful. Subsequently, the infant was referred to our radiology department for therapy to the remaining eye.

Pathologic examination

Grossly, there were no external abnormalities. The opened specimen revealed a white, irregularly nodular mass at the posterior pole (fig. 1). The highest elevation (four mm.) was directly over the optic nerve. The mass did not transilluminate.

Microscopically, the structures of the eye were normal except for the retina which was suddenly expanded at the posterior pole into a well-circumscribed, roughly globular tumor mass. This mass appeared to embody all the layers of the retina at the junction of normal and abnormal tissue.

The tumor mass was made up of deeply staining cells with scanty cytoplasm. In the peripheral areas of the tumor, these were grouped largely into typical Flexner-Wintersteiner rosettes. More centrally, the tumor showed "sleeve" formation around blood vessels. This portion of the tumor in part rested directly upon the lamina cribrosa of

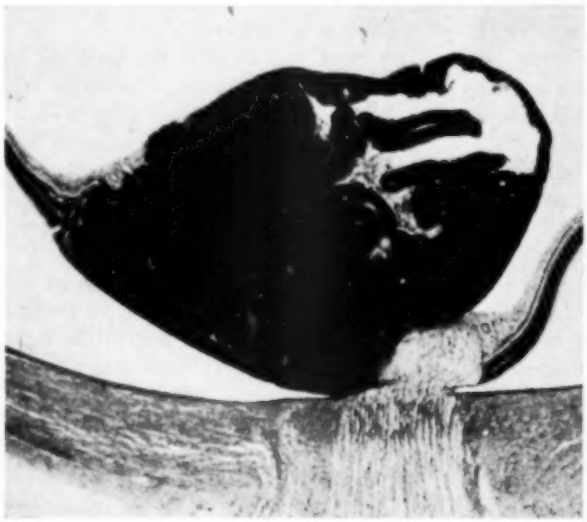

Fig. 2 (Hix and Danielson). Medium-power photomicrograph showing the relation of the tumor to the optic disc. Many rosettes can be seen in the portion nearest the vitreous, while the one third of the tumor nearest the nervehead is composed of the more undifferentiated "sleeve" formations.

the optic disc. See Figure 2.

The rest of the nervehead appeared to be made up of an expansion of the nerve-fiber layer of the retina. The optic nerve posterior to the lamina cribrosa appeared normal. No sections showed penetration of tumor cells beyond this area.

Approximately half way between the ora serrata and the nervehead, in an entirely different area, and showing only on two sections of the series, there was a small focus of Flexner rosettes in the ganglion-cell layer of the retina (fig. 3). The rosettes were about 12 in number and did not expand the retina appreciably. They did penetrate the outer nuclear layer but did not disturb the inner nuclear layer. This probably represents a primary tumor (independent focus) rather than a metastasis.

Diagnosis. Retinoblastoma, predominantly neuro-epithelioma in type.

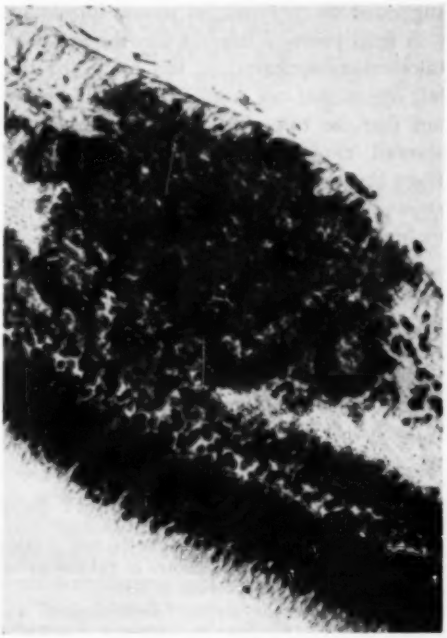

Fig. 3 (Hix and Danielson). High-power photomicrograph showing the small second focus of tumor rosettes in the retina.

Discussion

The early diagnosis of this tumor was difficult from several standpoints. As far as we know, there is no other case in the literature in which a retinoblastoma was followed from the time of its first clinical appearance.

There have been cases in which retinoblastoma was noted at birth. Singh[9] records six cases (eight percent) in the Moorfields Eye Hospital series between 1925 and 1947, but these were apparently far enough advanced to be diagnosed or suspected by the usual symptoms. We have, therefore, described the appearance of the fundi in as much detail as possible, in the event that the problem should arise again.

Although Reese quotes Weller as stating that the incidence of retinoblastoma is only one in 34,000 births, the fact that most hospitals having a premature nursery are conducting routine ophthalmoscopic examinations makes a repetition possible.

Reese makes the statement that these tumors are congenital, but in this case there was no clinical evidence that the tumor existed until the fifth ophthalmoscopic examination. This does not preclude its having been present microscopically, as demonstrated by the discovery on microscopic examination of a second tumor focus, which was quite invisible grossly.

Also a birth weight of 1,750 gm. would indicate a prematurity of, roughly, six to eight weeks. Discovery of the tumor at 58 days of age would postulate its presence at birth if the patient had been a full-term infant.

At the time we were examining this infant there was, and still is, some argument as to the normal appearance of a premature fundus. Our initial diagnosis was somewhat confused by a statement in Walsh's[10] *Clinical Neuro-Ophthalmology* to the effect that the macula of a premature frequently shows a pearly gray sheen with heaping up of retinal tissue, sometimes suggestive of a tumor. We have since seen this grayness of the macula but never to the extent that it

suggested the presence of tumor formation.

A final point of interest was the fact that calcification appeared in the tumor of the left eye within one week after its discovery but that the tumor of the right eye never showed clinical evidence of calcification. Even the microscopic sections of the tumor showed only a small area that might be undergoing calcification.

This may well account for the fact that the tumor in the right eye was the more rapidly growing of the two, since calcification is supposed to denote degeneration. Unfortunately we have never been able to obtain adequate X-ray demonstration of calcium in the remaining left eye, although we are certain that we see it with the ophthalmoscope.

SUMMARY

A premature infant developed bilateral retinoblastomas while in the premature nursery. He previously was suspected of having retrolental fibroplasia for which he was treated with cortisone. The eye was observed before clinical signs of tumor appeared, and during the early stages of tumor growth. A detailed description of the ophthalmoscopic findings is presented.

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We wish to express our appreciation for the assistance given by Dr. John C. Long in reviewing the pathologic findings; Dr. Lulu O. Luchenco, in attending the patient in the Premature Center; Dr. J. Leonard Swigert, for his surgical assistance; and Mr. Glenn Mills of the Department of Visual Education for the photomicrographs.

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OPHTHALMIC MINIATURE

Case 25. Both eyes blind, with appearance somewhat like glioma; no cause assigned. Charles O—, aet. 18 months. Believed never to have had any p. l., was brought to Mr. Liebreich, at St. Thomas's Hospital, when six months old. Has never shown symptoms of pain. In April, 1878, I found the right eye shrunken, cornea small, yellowish and semi-opaque; the left eye, no a.c., cornea and lens clear, a yellowish reflex behind the lens.

E. Nettleship,
Transactions of the Ophthalmological Society of the United Kingdom,
3:53, 1883.

AN EXPERIMENTAL STUDY ON THE EVALUATION OF HYDROSULPHOSOL* IN THE TREATMENT OF OCULAR INJURIES DUE TO CHEMICAL BURNS†

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INTRODUCTION

Ophthalmologists are constantly on the alert for drugs, chemicals, and new techniques which might lessen the extent of injury or give better visual results in the handling of chemical burns of the eye and its adnexa. Numerous investigators worked assiduously on this problem during the war and our knowledge of the basic mechanisms involved in ocular burns has been considerably advanced.

Through the combined efforts of certain eminent ophthalmologists in this country and abroad, certain broad principles of treatment were established. The most noteworthy result of their efforts was the finding of a suitable specific treatment for eyes burned with lewisite (beta-chloro-vinyldichlorarsine) by employing 2-3 dimercaptopropanol, commonly known as BAL (British antilewisite) and formerly known as D.T.A.

Following the fundamental investigations of the Oxford group that led to the use of BAL for lewisite lesions of the skin, Mann[1] and other British investigators were the first to evaluate BAL for ocular lesions. In view of the excellent results in lewisite eye injuries obtained by many British workers, BAL was tried in the United States. Work done with other previously recommended therapeutic agents for lewisite, such as hydrogen peroxide, potassium permanganate, and so forth, conclusively proved the superiority of BAL.

Hydrosulphosol* was the next substance which captured the attention of ophthalmologists following a report by Kuhn.[2] This worker summarizes her findings over a period of three years in more than 300 major chemical and thermal eye burns which had been treated with ophthalmic Hydrosulphosol oil.

The conclusions were that with its use pain was controlled at all times, healing was more rapid, visual restoration was accelerated, permanent disability was reduced, and there were fewer indications for conjunctival flaps. Further, the use of this material was based on its apparent value as a specific treatment for eye burns because of its chemical composition and a reputed ability to stimulate healing functions related to biochemical aspects of this particular organ.

Hydrosulphosol, Kuhn indicates, has also been a valuable adjunct in the treatment of eye injuries caused by anhydrides and detergents. The results were similar to those obtained from eye burns caused by chemical means. Kuhn[3] continues to use this product as a routine treatment for all chemical and thermal eye burns coming to the Kuhn Clinic Hospital. It is stated that 10 to 15 eye burns are treated each week, so that the total experience with this material now exceeds 1,000 cases.

Cruthirds[4] also investigated Hydrosulphosol in the treatment of corneal and X-ray burns. His conclusions were as follows:

1. A sulfhydryl therapy has been employed in treating a series of more than 500 burns involving injury to the eyes and adjacent areas over a period of five years.

2. Results observed indicate advantages over other methods expressed by (a) ability to heal X-ray burns in which tissue was devitalized, ulcerated, and infected; (b) healing was more rapid; (c) there was less scarring and less chance for development of symblepharon.

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* Hydrosulphosol is the registered trade mark of E. C. Lientz and Co., Inc., for their brand of sulfhydryl.

† From the Department of Ophthalmology, Temple University School of Medicine, Philadelphia. Candidate's thesis presented toward membership in the American Ophthalmological Society, accepted by the Committee on Theses.

3. Hydrosulphosol presents sulfur in a "free" colloidal state with a high concentration of sulfhydryl suggesting availability of sulfur in a form that can be utilized by the body in the synthesis of sulfur-containing amino acids.

4. A review of the literature reveals the importance of sulfur-containing compounds in the eye. Certain of these compounds have been shown to constitute almost one half of the mineral content of the lens and are connected with such functions as tissue respiration, oxygen transport, detoxication, capsular permeability, protein synthesis, and general metabolic efficiency.

5. In addition to its use as a treatment for burns, this product has been used in conjunction with penicillin in the treatment of multiple corneal ulcers with results not heretofore observed when using penicillin alone.

6. No contraindications have been observed for this product when used with other medications. There has been no evidence of any toxic reaction following free and repeated applications of this sulfhydryl-bearing material.

In a recent report, Mullen[8] states he was able to confirm the results obtained by Kuhn with reference to saving eyes and shortening treatment. This worker regards the material as having merit when he states, "The most important drug now used in combating serious damage to human eyes from strong alkalies and acids is Hydrosulphosol."

Spaeth[6] regards the use of sulfhydryl treatment as "almost ideal" for chemical burns in the manner outlined by Cruthirds and described by Kuhn. He states that the use of this substance for injuries due to anhydrides and detergents has shown similar results.

More recently Cruthirds[7] reported on the treatment of corneal scars following chemical eye burns and ulcers with sulfhydryl-bearing compounds. His conclusions were as follows:

1. Disappearance of heavy corneal scars and restoration of normal or near normal vision has resulted following application of sulfhydryl therapy in a series of five cases. When the conditions encountered and results achieved have been fully studied, this treatment appears to open a new, effective line of attack on some problems that have heretofore resisted all therapy.

2. A sixth case with corneal dystrophy indicates a possible favorable reaction of Hydrosulphosol therapy in stimulating specific sulfhydryl groups of the cornea associated with pain sensation and lacrimation.

3. Application of a sulfhydryl compound in the treatment of conditions generally classified as presenting "irreversible tissue damage" was prompted by results observed when using this therapy successfully on major chemical eye burns. Until this treatment was applied to eye burns, the most severe cases would result in scars, adhesions, and permanent damage. With this sulfhydryl preparation applied locally, even the most severe chemical eye burns heal quite promptly. In the study reported here a new sulfhydryl product prepared for oral use has been combined successfully with local applications in the treatment of old, thick, corneal scars that have proven resistant to all other forms of medication.

It has been reported that a large number of ophthalmologists in the United States have been questioned concerning their clinical experience with Hydrosulphosol. "Without exception those who replied reported that in severe cases ophthalmic Hydrosulphosol oil proved to be superior to anything they had used previously."[8]

The successful results thus obtained are exceedingly interesting and require further investigation. The material collected from various authors[2-4, 7] on their clinical experiences with Hydrosulphosol shows that they are overwhelmingly in favor of the sulfhydryl material. However, in contrast to reports of the extensive work done on BAL, no reference to chemical burns of the eye in laboratory animals treated with Hydrosulphosol could be found in the literature. Therefore, it seemed advisable to run a series of controlled experiments on the eyes of a suitable laboratory animal to determine if the results matched the clinical experience of those who had reported on Hydrosulphosol.

Our results on the investigation of ophthalmic Hydrosulphosol (five percent) in castor oil in the treatment of acid and alkali burns of rabbits' eyes demonstrated that the compound was not effective in this animal. Controlled eyes in which only saline lavage or castor oil was used healed in approximately the same length of time as eyes treated with

ophthalmic Hydrosulphosol (five percent). However, in the use of one chemical, iodoacetate, Hydrosulphosol treatment appeared effective.

Description of Hydrosulphosol

Physiochemical properties

Hydrosulphosol is a complex sulfur compound dispersed in water containing a labile sulfhydryl group. In the ophthalmic preparation a concentrate (five percent) is dispersed in castor oil. Other products available under the name Hydrosulphosol include a gel, ointment, and aqueous solution preparation.

The name "Hydrosulphosol" is a trademark owned by E. C. Lientz and Co., Inc., and is registered in the United States Patent Office as No. 364,381. The official or N.N.R. name submitted for consideration by the Council's Committee on Nomenclature as a synonym is "sulfhydryl."

Hydrosulphosol differs radically from "Vleminckx's" solution. This latter solution contains approximately 16-percent calcium and 25-percent flowers of sulfur. This high content of calcium in Vleminckx's solution makes it highly caustic and unsuitable for the treatment of burns, particularly ophthalmic burns.

Chemical analysis of Hydrosulphosol shows that it contains approximately 0.549-percent calcium and 1.53-percent sulfur. This ration of calcium to sulfur and the lability of Hydrosulphosol, as evidenced by exposure to air, confirm the fact that the calcium in the solution is not present in stechiometric proportion to the sulfur. However, Hydrosulphosol is relatively stable in the container. It is said that this clear, orange-colored solution does not undergo appreciable change if it remains in the original package unexposed to air.

Hydrosulphosol is produced in aqueous solution by reacting flowers of sulfur (U.S.P.) with hydrated lime in water. A chemical analysis of Hydrosulphosol, according to Salle,[9] is as follows: specific gravity, 1.032; pH of solution (glass electrode), 10.2; solids remaining after evaporation of 100 gm. solution to constant weight, 10.56.

Percentage of constituents	
Calcium from calcium oxide	0.549
Total sulfur (iodine titration)	1.46
Sulfur as sulfide ion	0.30
Sulfur as thiosulfate ion	0.22
Sulfur as polysulfide	1.256
Sulfhydryl ion (methylene blue titration)	0.237

The optical clarity of the solution, aside from the yellow-orange color due to polysulfide, indicates that the original undiluted exists as a true solution. It is known that when polysulfide solutions are diluted, and especially when they are acidified, they become unstable and liberate colloidal sulfur as indicated by the milky or turbid appearance. In dilution, sufficient acidification is produced by the absorption of carbon dioxide from the air to yield colloidal sulfur and produce a slight odor of hydrogen sulfide (La Mer[10]).

Pharmacology of Hydrosulphosol

In order to determine toxicity, guinea pigs were fed Hydrosulphosol daily for a period of 90 days by Salle.[11] The amount administered was equivalent to three ounces of the solution for a 150-pound human. Oral administration of Hydrosulphosol produced no demonstrable toxic symptoms in the animals.

Subsequently Salle and Korzenovsky[9] studied the effects of this medication on embryonic chick heart and reported that it was relatively nontoxic to embryonic chick-heart tissue fragments cultivated in vitro. These investigators also presented evidence to show that Hydrosulphosol is an available and convenient source of SH-radical. Mellon,[12] in his studies of sulfur metabolism, reported the results of his experiments on the stimulatory effect of high dilutions of Hydrosulphosol on chick-heart embryo fibroblasts.

Functioning in such fashion in relatively high dilutions suggests the effect is an enzymatic one. The SH-linkages are well

known to function as coenzymes in certain respiratory systems which implement cell nutrition.

In further support of the biochemical implications of the Hydrosulphosol treatment of burns is the abundant evidence for the importance of the SH-radical in tissue respiration and repair. Elvehjem[13] has suggested a mode of action for Hydrosulphosol as being stimulatory to certain enzymes, particularly succinic acid dehydrogenase.

Sullivan and Praetz[14] reported studies on the use of Hydrosulphosol and other sulfur sulfhydryl-containing compounds including BAL in animal experiments with alloxan. The mechanism of alloxan diabetes was found to be due to the selective necrosis of the beta cells in the islets of Langerhans in the pancreas. Alloxan has been found to combine with sulfhydryl groups of various enzymes and sulfhydryl groups of proteins. The discovery that alloxan diabetes results in the rapid development of cataracts affords a new opportunity for the study of treatment and prevention of cataract (Root[16]).

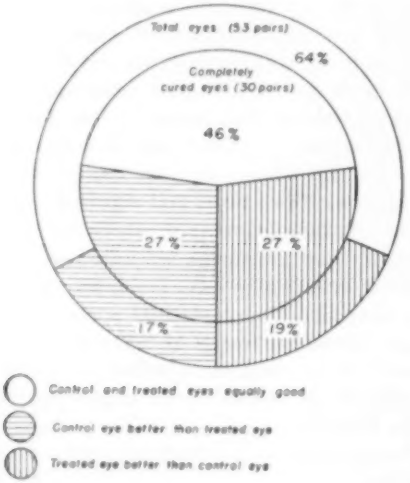

Fig. 1 (Harley). Graph to illustrate that the Hydrosulphosol-treated eye and the nontreated control eye healed in equal fashion in the majority of instances. The inner circle expresses the same idea for the eyes which became clinically cured.

Bellows[17] has pointed out that almost one half (45.8 percent) of the total ash of the normal lens of the eye consists of sulfate arising from the combination of cysteine, glutathione, and other sulfur-bearing constituents. The SH-content of the lens is known to decrease with cataract formation.

In vitro the action of Hydrosulphosol and BAL were found to be the same on the basis of their capacity to change alloxan to dialuric acid rapidly. Animal studies showed BAL protected the animals from the convulsive effect of alloxan. Further animal studies have been reported by Sullivan and Mazarella[15] on the effects of alloxan with and without Hydrosulphosol. It can be shown that Hydrosulphosol protects animals from the convulsive effects of alloxan.

Williams and Bissell[18] reported on the healing of clean wounds in animals and the drop in pH following the application of Hydrosulphosol diluted 1:4. The original pH of the diluted solution was 9.5. In three minutes after application the pH had dropped to 7.9 on wound No. 1 and 8.1 on wound No. 2. Cruthirds also found that the pH of the Hydrosulphosol quickly reached levels consonant with tissue function. The study of wound healing showed that no definite benefit was derived from the use of Hydrosulphosol as judged by frequent observations of the wounds, their strength, or microscopic changes.[18]

When applied in accordance with recommendations based on clinical experience, the use of Hydrosulphosol repeatedly has been attended with the uniform healing of new burns without clinical evidence of infection. In vitro tests on certain organisms such as Streptococcus, Staphylococcus aureus, Staphylococcus albus, B. pyocyaneous, and B. coli show that the bacteriostatic effect of Hydrosulphosol is too weak to suggest that the primary action is bacteriostatic. However, workers acquainted with the properties and action of this product attribute its capacity to prevent or abate infection in burns to its probable action as a tissue stimulant.[7]

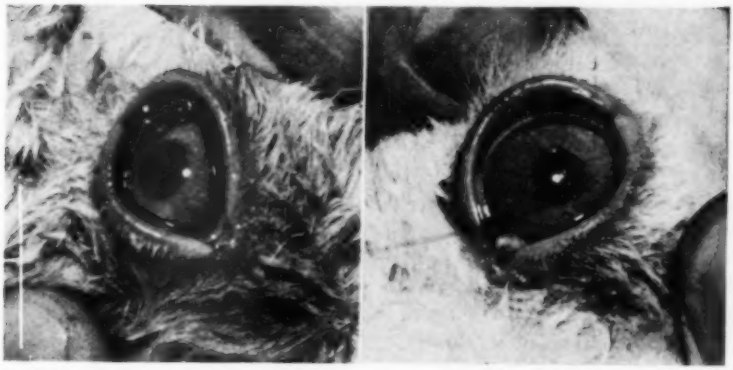

Fig. 2 (Harley). Right eye treated with Hydrosulphosol; left eye, nontreated control. The lesion was made with two microdrops of five percent maleic anhydride. Photograph taken at end of four days. Both corneas have the same degree of opacity but the conjunctivitis is more marked in the treated eye.

Method of study

Among the important problems in the investigation of chemical burns of the eyes for experimental purposes are:

1. Production of a standard lesion which can be controlled within limits of moderate severity.
2. Finding a method for grading the lesion which is to be produced.
3. Systematic measurement of the severity of the ocular reaction following the burn.
4. Choice of a laboratory animal.

I. Standard lesion

It is well known among investigators that this first criterion for the study of chemical burns of the cornea proves to be the most difficult. The subject of standard lesions has been excellently reviewed by Friedenwald and Scholz[19] and Warthin and Weller.[20]

Splash technique. In the production of a lesion by a liquid chemical, a distinction must be made between a single "splash" application and a "splash and blink" application.

In the simple "splash" application the animal's eyes are held open until the liquid has been absorbed by the tissue to which it is applied or until the excess of liquid is removed by irrigation with water or saline solution after the droplet has been in contact with a tissue for a given time. The localized lesion thus produced has been criticized because it does not simulate the "physiologic lesion" sustained by an actual line-of-duty accident.

To overcome this objection the "splash and blink" technique was devised wherein the animal's eyes are closed immediately after application of the chemical. This technique most nearly reproduces the contingencies of the usual occupational or war hazards and is generally used when potential therapeutic agents are to be tested. It has the disadvantage that the chemical is spread unevenly over the cornea and conjunctiva, producing an irregular and inconsistent reaction. When a strictly localized and highly reproducible lesion is desired some form of the simple "splash" technique is often preferred.

Rod technique. Exceedingly small droplets can be delivered to eyes of animals from finely drawn glass rods, but such rods are difficult to reproduce. These methods were refined by Armstrong[21] who devised a set of stainless steel rods, the ends of which were carefully machined down to a cross section varying from two mm. to less than one mm. The ends of the rod were polished so that by capillary attraction they would pick up a constant amount of chemical. Numerous modifications of this method have been devised and in some techniques the error of

delivery is not in the interest of accuracy.

Drop method. Various microburettes and micropipettes have been used for the delivery of a droplet of a chemical directly to the eye. Scholz[22] devised a 0.25-cc. tuberculin syringe in which the plunger was activated by a micrometer screw. Volumes as small as 0.1 c.mm. can be expelled from such a needle with an accuracy of 20 percent. With droplets in this range, approximately 50 percent of the fluid adheres to the needle, requiring contact with the eye for removal. This leads again to uncertainty in the amount delivered, even though it may appear constant.

Filter paper application. A small disc of filter paper is placed on the animal's cornea and pressed into contact with the tissue by an applicator. A measured dose of the chemical is then delivered from a micrometer syringe to the filter paper. After a given period the filter paper is removed and, without allowing the eye to close, the surface is flushed with water or normal saline solution. A severe, sharply localized lesion is obtained which shows very little variation from animal to animal. This method has apparently yielded the most nearly standard and reproducible lesions of the simple "splash" type thus far studied.[22]

My method. In order to produce a standard lesion for the various chemical agents used in these experiments, effort was made to select the most appropriate and reliable methods from the aforementioned recognized techniques. Several variations were tested over a period of three weeks until a standard, reproducible lesion was encountered.

The first method that was found satisfactory consisted in the use of a standard burette to which was attached a pipette for the delivery of small drops. The pipette was maintained at a standard distance (five cm.) from the eye. The rabbit had been previously anesthetized by intravenous sodium pentothal. The lids were held free from the eyeball by a small speculum and the nictitating membrane kept out of the field by a small clamp.

The rabbit cornea was covered by filter paper measuring six mm. in diameter which was held in place by the moisture of the cornea. The chemical was delivered at the rate of one drop every five seconds until 0.5 cc. had been used. The filter paper insured simultaneous spread of the chemical to an equal degree over the corneal surface.

The chemical agent remained in contact with the cornea by means of the soaked filter paper for five minutes. Then the filter paper was gently removed and the eye was washed with normal saline solution using a standard wash bottle. The chemical agents tested by this method were 0.5N H_2SO_4, 0.5N HCl, and 0.25N HCl.

The second method which provided con-

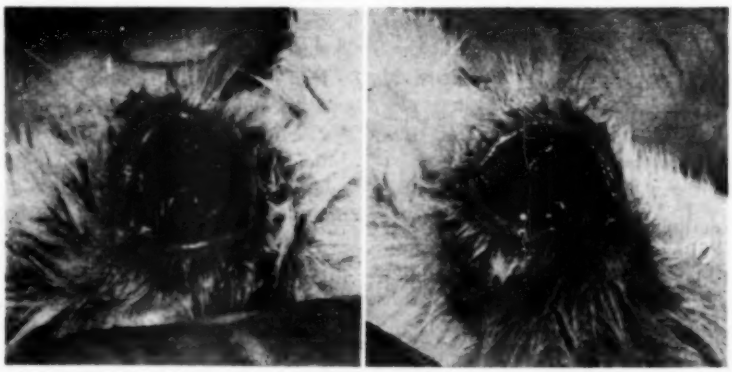

Fig. 3 (Harley). Left eye treated with Hydrosulphosol; right eye, nontreated control. The lesion was made with one microdrop of one percent NaOH. Photograph taken at the end of four days. The corneal lesion is more advanced in the treated eye.

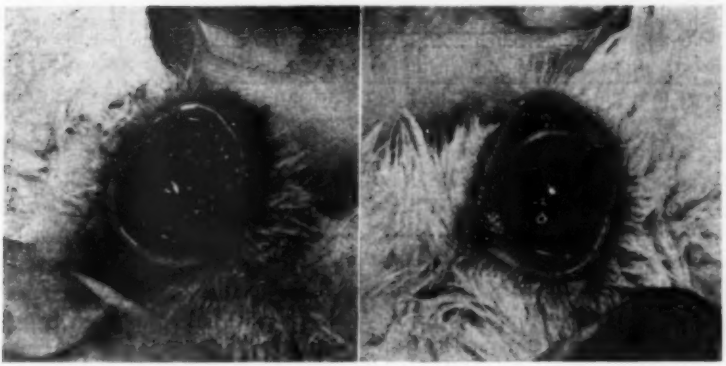

Fig. 4 (Harley). Right eye treated with Hydrosulphosol; left eye controlled with pure castor oil. Lesion made with one microdrop of 1N HCl. Photograph taken at the end of three days. The corneal lesion in the treated eye is better, but the conjunctivitis is more marked than in the control eye.

sistently reproducible lesions was the micropipette technique, in which the fluid was removed by a small air jet.

Glass rods were prepared in a hot flame and pulled to a capillary size while in the molten state. The ends of the pipette were smoothed, polished, and tested for delivery of a constant amount of chemical. It was found that the fluid always went to the same level in the tube by capillary attraction.

After repeated testings it was found that the best micropipette delivered 0.0047 cc. of chemical solution. The amount delivered by each pipette is constant for that pipette. By attaching a small rubber tube to the other end of the rod a weak jet of air was introduced which removed all of the chemical each time in a completely consistent fashion.

The animals were anesthetized with intravenous sodium pentothal. The lids and nictiating membrane were cared for in the same fashion as described in the first method. The microdrop was allowed to fall on the naked cornea midway between the pupillary center and superior limbus. It had been previously found that chemicals delivered to this portion of the cornea produced a maximal tissue response.

The dropped chemical was permitted to remain undisturbed or undiluted for 60 seconds on the cornea. Then the eye was thoroughly irrigated with normal saline solution for three minutes. It was observed that despite rather profound narcosis the rabbit almost invariably showed signs of distress when the chemical was applied to the cornea.

In some instances a second microdrop was blown on the cornea 60 seconds after the first and another 60 seconds was allowed to elapse before washing. This method was required when the chemical used failed to produce a lesion of adequate severity.

The chemical agents tested in this fashion were 1.0-percent NaOH, 5.0-percent maleic anhydride, 10-percent maleic anhydride, 0.33 M acetic acid, 1N HCl, 25-percent maleic anhydride, 0.001 M iodoacetate, 0.01 M iodoacetate, 1.0 M iodoacetate, and 1.0-percent H_2SO_4. For certain other chemicals (concentrated creosol, concentrated lactic acid, 33-percent creosol, 50-percent lactic acid) a larger drop was used for producing a severe lesion. The various chemicals and the methods employed for their use can be reviewed in the appendix.

The third method consisted in the intracorneal injection of chemicals designed to produce a lesion. Lesions were produced but two factors hampered attempts at standardization: first, the amount of injected chemical is difficult to control; and secondly, the physical damage to the cornea by the needle and fluid cannot be kept constant, as lesions will vary with the corneal depth. The chem-

ical agents tested by this method were 0.33 M acetic acid and 0.001 M iodoacetate.

The fourth method was the application of desiccated calcium oxide (CaO) or lime to the cornea in the form of a measured quantity of the powder applied on the end of an applicator. The solution of calcium oxide Ca(OH) is relatively innocuous. The dry, powdered lime remained in situ and reacted with the cornea for 20 seconds. The eye was then thoroughly washed for 60 seconds. While one can foresee certain inconsistencies in this method, the standard severity of the lesion was rarely a cause for disappointment.

Preparation of the treated and control eyes. In each of the four methods the rabbit's eyes were prepared in the same fashion. Prior to the application of the chemical, small, fine wire loops were placed through the tarsal plate of the upper and lower lid of each eye. The purpose of the wire loops was to secure the lids by means of a fine black-silk suture. In this way the lids could be opened or closed at will two or three times each day until the eyes were well.

This addition to the technique was imperative since Hydrosulphosol is known to work only when it is instilled into the cul-de-sac and a tight bandage is applied. Since the treated eye was receiving this "closed" treatment, the control eye was likewise prepared with wire loops and closed.

Immediately following the cessation of the burn and the saline lavage, the treated eye was flooded with a fresh solution of Hydrosulphosol (five percent) in castor oil. This compound was reinstilled several times before the lids were closed. A milky Harderian secretion often flooded the cornea within five minutes. The treated eye received more Hydrosulphosol approximately four or five hours later that same day and thereafter twice a day for five to 10 days depending on the progress of the lesion.

TABLE 1

NUMERICAL ESTIMATION OF SEVERITY OF OCULAR LESIONS
(After Friedenwald)

Symptom		Maximum Grade Points
Corneal opacity		
Intensity		8
Area		4
Less than one fourth of cornea	1	
Less than one half of cornea	2	
Less than three fourths of cornea	3	
Over three fourths of cornea	4	
Duration		4
1 to 3 days	1	
4 to 6 days	2	
7 to 13 days	3	
14 days & over	4	
Corneal edema or bulge (seen with hand slitlamp)		4
Corneal slough or ulceration		4
Denuded epithelium	1	
Moderate slough	2	
Pronounced slough	3	
Perforation	4 (100% lesion)	
Pannus (including density and length)		4
Conjunctiva		
Redness		2
Edema		2
Necrosis		2
Discharge		2
Iritis		4
Small pupil and photophobia	1	
Congestion of iris or aqueous ray	2	
Exudative iritis	3	
Panophthalmitis	4	
	40×2.5%	100%

II. GRADING SEVERITY OF EYE LESION

After a given lesion was produced in the eye, it was essential to have some system for recording the severity of the ocular reaction. Two grading devices were found acceptable for the Hydrosulphosol experiments, those of Friedenwald, Hughes, and Herrmann[23] and Carpenter and Smyth.[24] Although each method tends to produce comparable scores for recording, the former was found more complete.

It may be questioned in the system just mentioned whether sufficient weight was given to the more important structures. For instance, there is considerable difference in the clinical significance between a mere conjunctivitis and a corneal slough, and yet the numerical grading does not reflect this change. The weighting of the different signs

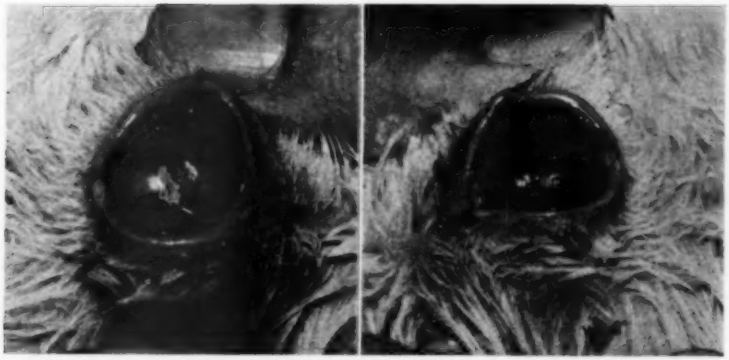

Fig. 5 (Harley). Right eye treated with Hydrosulphosol; left eye controlled with pure castor oil. The lesion was made with 0.5 cc. of 0.25N HCl. The lesions are of equal severity in the two eyes. Photograph taken at the end of three days.

may be altered depending on the type of problem being studied. However, the validity of such a system of grading has been investigated by its author. The average recorded severity of the reaction of different sets of eyes exposed to a graded dose of chemical forms a smooth curve which is not linearly proportioned to the dose.

Independent readings by several experienced observers are in remarkably common agreement. This statement is in accord with the observations of the writer. Friedenwald emphasized that, in his classification, a lesion of grade 11 was not precisely 10 percent more than a grade of 10. With this statement, I am also in substantial agreement, since any attempt to convert this grading system into one based on percentage of a total lesion will be confusing and erroneous.

It is noted that the factor 2.5 is used in order to convert the grading system into percentage. This method contains an inherent source of misunderstanding because the values so assigned are ordinal and not cardinal numbers. Ordinal numbers are assigned in order, such as first, second, third, and so forth. The relationship between first and second is not at all necessarily the same as that between second and third.

Cardinal units, however, can be treated arithmetically and hence added. This is not true of values expressed in ordinal units, for they cannot be added except to give ordinal sums. Two such ordinal sums, although of the same expressed ordinal value, may or may not be equal.

Although the sum in this grading system may be said to be representative of ocular damage in so far as a large sum represents extensive damage or a small sum represents superficial damage, two cases with the same sum might be entirely different in extent and severity, or they might be identical. For this reason, it was felt that comparing the numerous lesions by percentages would introduce a definite error.

For the grading of lesions in the Hydrosulphosol experiments, the Friedenwald grading system was used together with the system described by Carpenter and Smyth.[24] However, no attempt was made at adding the ordinal numbers and treating them in terms of percentage of severity.

The rabbit's eyes both in the control and in the treated animal were examined daily and the various constituents of the classification were scored. Following a period of a week or two, enough numbers had been assembled so that they could be easily compared with one another.

In these experiments, each constituent part of the score for the control eye was challenged by the individual record of the treated eye. The object was to determine if the con-

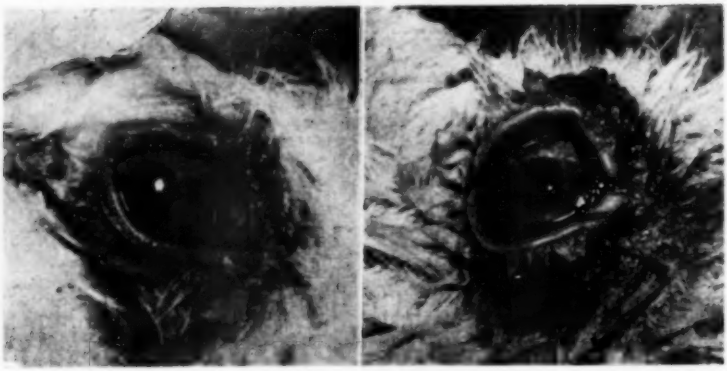

Fig. 6 (Harley). Both eyes treated with Hydrosulphosol. The lesion was made with two microdrops of five percent maleic anhydride. Photograph on the left was taken at the end of two hours. Photograph on the right was taken at the end of two days and shows some improvement in the corneal opacity.

trol eye was better than, the same as, or worse than the treated eye. It was arbitrarily arranged that the numbers would have to differ by more than one to be significant.

Actually, the scoring system corresponded amazingly well with the clinical impression of the eyes recorded by several experienced ophthalmologists.

By scoring the residual ocular damage at a time when the eye appeared clinically healed or, at least, clinically unchanged, one obtained two sets of figures which lent themselves to careful scrutiny. Daily fluctuations were found to be misleading. For the purpose of judging the efficacy of a Hydrosulphosol-treated eye as compared to a control eye which received no treatment, this scheme proved to be rational.

III. Choice of a Laboratory Animal

All of the Hydrosulphosol experiments were performed on white rabbits of approximately the same weight and age. Black rabbits have been found to be less susceptible to chemical agents than white rabbits. Old rabbits have eyes that are more resistant to

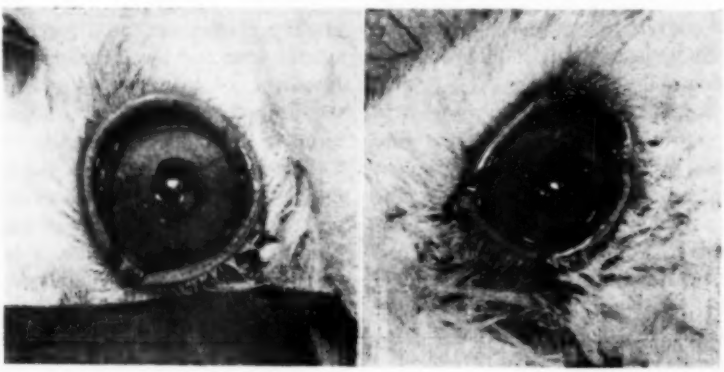

Fig. 7 (Harley). Both eyes were nontreated controls. The lesions were made with two microdrops of five percent maleic anhydride. Photograph on the left was taken at the end of two hours. Photograph on the right was taken at the end of two days; the cornea shows some improvement in the opacity.

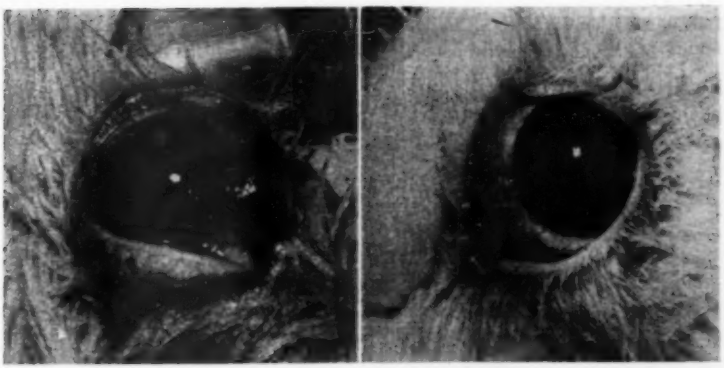

Fig. 8 (Harley). Right eye treated with Hydrosulphosol; left eye, nontreated control. The lesion was made with one microdrop of five percent maleic anhydride. Both corneas are clear and the eyes appear clinically well except for a mild conjunctival edema in the treated eye. Photograph taken at the end of three days.

chemical injury than young ones. Variations in results can be minimized by attention to selection of animals.

Results and observations. Chemical burns of the cornea differ in their rate of onset, symptomatology, depth of involvement in the cornea and conjunctiva, and their eventual prognosis. Certain factors are generally recognized as prominent in determining the nature and extent of injury: (1) The amount and duration of exposure; (2) the reactivity of the noxious substance with tissue components; (3) the physical characteristics which determine penetration of the chemical through cell membranes and its direct effect on these membranes (Grant[25]).

In these experiments for the determination of the efficiency of Hydrosulphosol in the treatment of various chemical burns, the following chemicals in varying strengths were used; hydrochloric acid, sodium hydroxide, maleic anhydride, acetic acid, iodoacetate, sulfuric acid, creosol, lactic acid, and calcium oxide (lime).

The aim was to produce a lesion of moderate severity; therefore, considerable attention was given to the strength of the material and the duration of the exposure. It

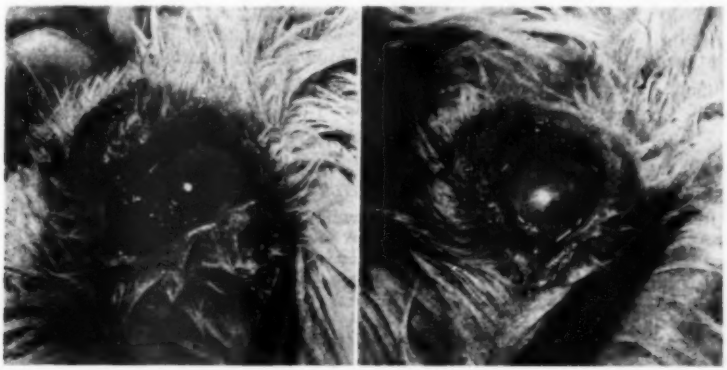

Fig. 9 (Harley). Left eye treated with Hydrosulphosol; right eye, nontreated control. The lesion was made with 0.5 cc. of 0.25N HCl. The treated eye shows less corneal opacity than the control eye. Photograph taken at the end of 15 days.

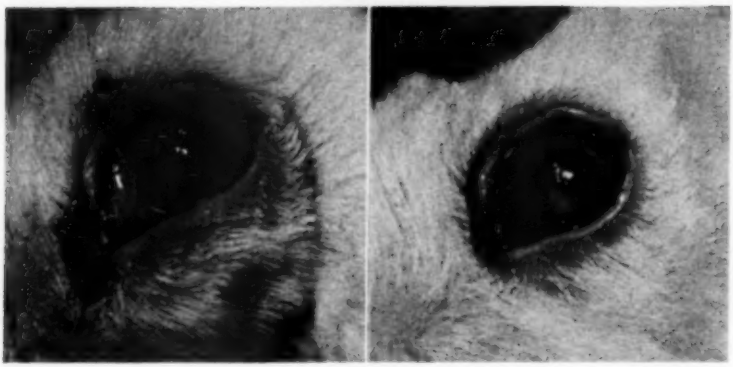

Fig. 10 (Harley). Two unpaired rabbit eyes. The one on the left was treated with Hydrosulphosol for seven days and the one on the right was a nontreated control. Both corneas show a healed vascularized scar. The corneal scar in the treated eye is somewhat less intense. The lesion was produced by 0.5 cc. of 0.25N HCl.

can be understood at once that a maximal lesion is unsuited for antidote evaluation study.

Following the production of the standard lesion and the use of Hydrosulphosol in the eye under treatment, the eyes were reexamined in four to five hours. A two-percent aqueous fluorescein was used to estimate the extent of corneal staining. The degree of corneal opacity and the conjunctivitis were noted at this time. The eyes were thoroughly examined again in 20 to 24 hours with a special Spencer laboratory biomicroscope using the routine staining technique. Each eye was scored and Hydrosulphosol was reinstilled.

A total of 157 rabbit eyes were tested with chemical agents. Thirty-five eyes were used purely for the production of standard lesions and did not enter into the final results of the treated eyes. Most of the results were calculated on the basis of the paired eyes of one animal. However, the first 40 eyes tested were used alternately as control or treated animals. We felt disinclined to close both eyes of a rabbit in a crowded cage since many have a carnivorous tendency toward the parts of a defenseless animal. Later, when cages were less crowded, both eyes of the same animal were employed. The remainder of the eyes tested represent paired eyes.

Before using Hydrosulphosol in the treatment of burned eyes, it was necessary to determine local toxicity of the material for rabbit eyes. The Hydrosulphosol had no deleterious effect in the normal rabbit's eye. However, one interesting effect was observed which requires mentioning.

In the acid burns it was noted that the cornea became gray immediately following

TABLE 2

RESULTS IN 53 PAIRED RABBITS' EYES IN WHICH CORNEAL LESIONS WERE PRODUCED WITH VARIOUS CHEMICALS BY DIFFERENT TECHNIQUES

	Hydrosulphosol Better than Control	Hydrosulphosol Equal to Control	Control Better
Cases completely cured	8	14	8
Cured with healed scar	1	16	1
Not cured (corneal ulcer)	1	4	0
Total	10 (19%)	34 (64%)	9 (17%)

the saline irrigation. Following the instillation of Hydrosulphosol, the corneal opacity frequently cleared within 20 minutes so that, by this time, the treated eye appeared greatly improved over the control eye. However, this temporary improvement seen in the treated animals frequently disappeared by the next day.

It was discovered that castor oil would clear the corneal opacity in the same fashion as the Hydrosulphosol. In fact, it appeared to be the castor oil in Hydrosulphosol which was responsible for the dehydrating process which cleared the corneal edema. Two pairs of eyes were burned with 1N HCl and one pair with 0.5 cc. of 0.25N HCl, after which castor oil was dropped in the control eye and Hydrosulphosol placed in the treated eye.

No clinical difference was noted in the rate of healing of the corneas when the two substances were compared. The conjunctival reaction, however, was much more marked in the Hydrosulphosol eye.

Two additional pairs of eyes were injured with 0.25N HCl by the filter paper technique. Castor oil was compared with the control eye which received no treatment. In one case the control eye was better in six days and in the other case the castor-oil treated eye was better in 14 days.

Fifty-three paired rabbit eyes were selected for the experiment dealing with Hydrosulphosol in treating the chemically injured eyes as compared with the control eye. An analysis of the abstracted results appears in Table 2.

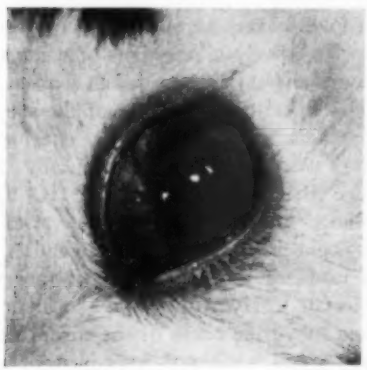

Fig. 11 (Harley). Final stage of a standard lesion produced by a microdrop of one percent NaOH, showing a healed vascularized scar.

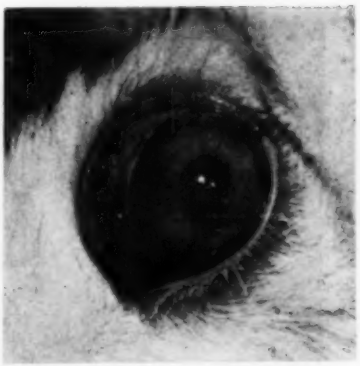

Fig. 12 (Harley). The final stage of a standard lesion produced by a microdrop of five percent maleic anhydride, showing a healed vascularized scar.

The following chemicals in paired rabbits' eyes were studied: 1N, 0.5N and 0.25N HCl in 25 pairs of eyes; 1 percent NaOH in 6 pairs of eyes; 5 percent, 10 percent, and 25 percent maleic anhydride in 9 pairs of eyes; 0.33 M acetic acid in 4 pairs of eyes; 0.001 M, 0.01 M and 1 M iodoacetate in 5 pairs of eyes; 1 percent H_2SO_4 in 4 pairs of eyes; 33 percent and concentrated creosol in 3 pairs of eyes; 50 percent and concentrated lactic acid in 3 pairs of eyes; and lime (CaO) in 2 pairs of eyes. The paired eyes used to evaluate BAL or castor oil compared to the control do not appear in Table 2.

The results in Table 2 show that the Hydrosulphosol-treated eye is neither superior nor inferior to the controlled eye in which no treatment was used. Statistical analysis of these figures by the chi-squared technique indicates that the probability that Hydrosulphosol is different from the control is less than one percent. Since this is true, it supports the hypothesis that the choice for the use of Hydrosulphosol is a matter of indifference.

Fig. 13 (Harley). The lesion was made with 0.5 cc. of 0.25N HCl in an eye treated with Hydrosulphosol. Clinically there was a heavy scar with an ulcer in midcornea at the end of 15 days. The epithelium is intact. The anterior stroma is heavily infiltrated with round cells and polymorphonuclear leukocytes. There is early fibroblastic proliferation and neovascular formation. (×150.)

Table 2 makes no attempt to differentiate the results of different chemicals. Examination of the records of the individual chemical agents used exhibits no obvious superiority for the Hydrosulphosol-treated eye over the control eye or vice versa except in three isolated instances. These statements were in close agreement with the clinical observations made prior to studying the results on paper.

In the case of 0.001 M iodoacetate in which 0.02 cc. was injected intracorneally the results differed from the usual pattern. The Hydrosulphosol-treated eye showed a certain superiority in three paired eyes. In one case, the treated eye was cured in four days while the control eye was not yet well at the end of 14 days. In the second case, the Hydrosulphosol-treated eye was better but the final results were not so brilliant. In the third case, the sulfhydryl-treated eye was superior to the control eye and was well in eight days. This observation was in accord with the known enzyme-inhibiting properties of iodoacetate. Yet, maleic anhydride, which belongs to the same selective inhibiting class of agents, showed no difference in the response to Hydrosulphosol medication which is theoretically capable of delivering an excess of the sulfhydryl ions to the tissue.

During the course of the experiments, an attempt was made to study the clinical characteristics of the various noxious agents used. Since most of the chemical agents used were acids, numerous observations were made. My notations corresponded closely with the description presented by Friedenwald, Hughes, and Herrmann[26] in their comprehensive work on acid burns of the eye. I was also able to confirm the day-to-day observations on alkali burns of the eye (Hughes[27]). It was noted in my experiments, however, that, while the acid burns gave a maximal reaction in 24 to 48 hours, the alkali burn frequently showed relatively minor signs of damage in 24 hours and then proceeded to worsen.

The clinical characteristics of the specific protein denaturants and selective enzyme inhibitors used did not differ materially from the eye tissue response to 0.25N HCl when allowances are made for the usual variations in biologic material. However, mention has been made of the response of intracorneal iodoacetate to Hydrosulphosol (sulfhydryl). Maleic anhydride burns of the cornea failed to show any additional improvement with sulfhydryl therapy.

Burns of the eye with lactic acid and creosol (carbolic acid and tar) produced con-

siderable tearing at the time of instillation, and the corneal opacity which formed immediately appeared deep. At the end of 24 hours, there was a moderate amount of mucopurulent discharge, hyperemia, and edema of the conjunctiva. The burned area was sharply demarcated on the cornea as a thick, gray, slightly elevated lesion. It appeared to reach its maximal effect by 48 hours and then regressed. For this reason, it resembled a typical acid burn of the cornea in which the epithelium had a coagulated appearance.

One of the more difficult problems that confronted us was secondary infection of the eye. In certain cases the Hydrosulphosol treated eyes would be healing more rapidly than the controls by the third or fourth day or vice versa. Then secondary infection would become established, with the result that the lesions in each eye would become equalized. The temporary advantage enjoyed by one eye would immediately be lost in the grossly infected eye.

Many sources of infection were suspected. Hydrosulphosol was cultured and reported as "no growth." Cultures were taken from infected eyes as well as from apparently clean control eyes.

A study of Table 3 suggests that the nonhemolytic Streptococcus, intestinal type, and the coagulase positive Staphylococcus aureus were participating in the infection. The intestinal type Streptococcus may be a part of the normal flora.

Consideration was given to use of a penicillin, aureomycin or sulfa ointment to reduce the infection when present. However, in view of their known retarding effect on epithelial regeneration, ointments were withheld in order not to complicate our observations. The use of liquid preparations was not uniformly satisfactory. The instillation of

TABLE 3

AEROBIC AND ANAEROBIC CULTURES

No.	Control Eyes	No.	Hydrosulphosol Eyes (infected)
2739	Occ. staph. albus—coag. neg. Occ. diphtheroids	24	Occ. staph. aureus—Coagulase pos. Few diphtheroids. Mod. no. nonhemolytic strept. intestinal type
2745	No growth in 5 days	27	Proteus vulgaris. Mod. no. nonhemolytic strept. intestinal type
2744	Occ. staph. albus—coag. neg.		
2743	Occ.staph. aureus—coag. neg.	29	Occ. staphyl. albus—coagulase neg. Mod. no nonhemolytic strept. intestinal type
2742	Occ. staph. albus—coag. neg.		
2741	Occ. diphtheroids	30	No growth in 5 days
2678	Staph. aureus—coag. pos. Staph. albus—coag. neg. Many diphtheroids Occ. Neisseria	31	Occ. staph. aureus—coag. pos. Occ. staph-albus—coag. neg. Few nonhemolytic strept. intestinal type
2737	Few diphtheroids Occ. staph. albus—coag. neg.	32	Occ. staph. albus—coagulase neg. Many nonhemolytic strept. intestinal type. Few proteus vulgaris. Occ. diphtheroids
2740	Occ. staph. aureus—coag. pos.		
2738	Occ. diphtheroids Occ. Neisseria	32A	Occ. staph. aureus—coagulase pos. Proteus vulgaris. Few nonhemolytic strept. intestinal type
2494	Occ. nonhemolytic strept. intestinal type. Proteus vulgaris		
2495	No growth in 5 days		

Fig. 14 (Harley). Eye treated with Hydrosulphosol. The section through the ulcer shows complete disorganization and necrosis of the epithelium. The stroma is heavily infiltrated with polymorphonuclear leukocytes and round cells with edema of the posterior stroma. (×150.)

medicinal drops in the unanesthetized rabbits' eyes offers certain technical difficulties not encountered in the use of ointments.

Twenty clinical photographs and five photomicrographs have been selected to demonstrate some of the more typical lesions encountered during these experiments. It was our experience that the clinical picture of the eye often revealed more of the minor changes in the cornea than the prepared histologic sections. Corneal haziness due to cloudy swelling and mild opacities was not readily demonstrated in the prepared sections. Severe lesions of the cornea were readily visualized and followed the expected histologic pattern of edema, loss of epithe-

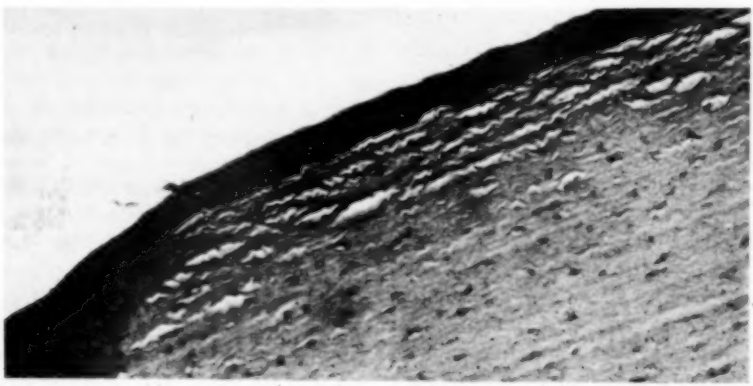

Fig. 15 (Harley). The lesion was made with 0.5 cc. of 0.25N HCl in a nontreated control eye. Clinically there was a light gray opacity which took a light stain with fluorescein at the end of five days. The epithelium shows several small ulcerated areas. The cytoplasm is diminished and some of the basal layers show pyknosis of the nuclei. The anterior stroma is thickened and irregular. The deeper stroma is edematous. The microscopic changes are minimal. (×150.)

Fig. 16 (Harley). The lesion was made with 0.5 cc. of 0.25 N HCl in a nontreated control eye. Clinically there was a light superficial opacity over 75 percent of the cornea but there was no staining at the end of 10 days. The epithelium is intact and appears to have recovered quite well except for some loss of cytoplasm in the basal layers. The anterior stroma is edematous and has lost some of its usual pattern. Some stroma nuclei are fragmented. The microscopic changes are minimal. (×150.)

lium, necrosis, marked cellular infiltration of the stroma, fibroblastic proliferation, and neovascular formation. The clinical picture of the eyes appeared to be a sensitive guide for comparing the relative severity of the treated and the controlled lesions.

Discussion

The basic aim of this study has been the evaluation of sulfhydryl as contained in Hydrosulphosol in the treatment of chemical burns of the rabbit's eye. While this investigation was not intended as a complete critique on the use of sulfhydryl in chemical eye burns, yet, as an introduction to controlled animal experiments for the study of this compound, certain interesting observations and facts have emerged.

My records in this investigation, comprising 53 paired rabbits' eyes, have shown that the use of Hydrosulphosol is neither superior nor inferior to the controlled eyes in which no treatment for the corneal lesion was used. The one exception was in the evaluation of the chemical iodoacetate, injected intracorneally.

The results in these experiments were not at all surprising in light of the recent comprehensive work on acid and alkali burns of the cornea and, especially, the specific protein denaturants and enzyme inhibitors to which references have been made.

In the case of acid, increased hydrogen-ion concentration of tissue appears to cause primarily denaturation of proteins. The corneal epithelium is usually conspicuously altered in appearance, presumably because of precipitation of its proteins, and does not undergo dissolution as in the presence of alkalies.[26]

Penetration of the cornea by alkalies is rapid, possibly as a consequence of saponification and destruction of the fatty epithelial barrier. Characteristically, the corneal mucoid is denatured, released, or partially removed from its association with the other principal structural component, collagen.

The same kind of chemical changes in the cornea and other tissues appear to be produced by different alkalies, sodium, ammonium, and calcium hydroxides, as well as organic amines, with variations principally in the severity and depth of involvement (Hughes,[27] McLaughlin[28]).

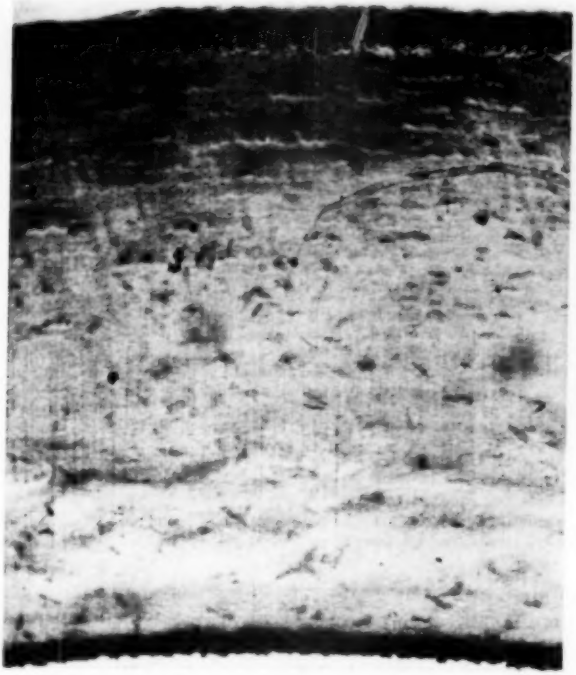

Fig. 17 (Harley). The lesion was made with 0.5 cc. of 0.5N H_2SO_4 in a nontreated control eye. Clinically, at the end of 31 days, there was a moderate opacity over the upper half of the cornea which did not stain with fluorescein. The epithelium is intact but the basal layers show some increased cellularity and thickening. Bowman's membrane cannot be recognized. Some changes in the anterior stromal pattern are apparent and the posterior stroma is somewhat edematous. Altogether, there are a few microscopic changes to be seen. (×150.)

Two pairs of eyes were burned with 1N HCl by the splash air-jet techniques to determine the effectiveness of BAL in acid burns. The paired eyes were well in four and five days, respectively. No difference was detected in the rate of healing for the control or BAL eyes. Since sulfhydryl is the active principle in both Hydrosulphosol and BAL, it is not surprising that the latter was no more successful in the treatment of ordinary acid or alkali burns than Hydrosulphosol.

The necessity for rapid treatment by the specific antidote has been emphasized by Mann, Pirie, and Pullinger[29] in the use of BAL for lewisite burns. Application of BAL in a 10-percent solution within five minutes after contamination of the eye with lewisite gave excellent results. For a 20-percent solution, the time can be extended to no more than 15 minutes after contamination to still obtain good results. Beyond 30 minutes, the eyes were lost despite the energetic use of BAL.

It follows that there is a direct relationship between time of application for this specific antidote and final visual results. This fact was given consideration in the use of Hydrosulphosol and rapidity of treatment was emphasized.

In contrast to the acids and alkalies, certain other compounds react with or become attached to specific groups in the tissue proteins and alter their biologic properties. In several instances, the denaturation of certain structural or enzymatic constituents of the cornea can produce specific types of toxic responses. Specific protein denaturants actually combine chemically with the reactive groups characteristic of proteins such as sulfhydryl, amino, carboxyl and hydroxyl (Grant[30]). Some of the known specific protein denaturants are 2-chloroethyl sulfur and nitrogen compounds, methylating agents,

arsenicals, certain activated halogen compounds, aldehydes, and lacrimators such as iodoacetate.

Mackworth[30] has shown that lacrimators such as ethyl iodoacetate and bromoacetophenone inhibit all the enzymes which are generally accepted as thiol enzymes, the inhibition being progressive and irreversible in all cases. The enzymes can be protected against the inhibition by reduced glutathione, cysteine, or denatured enzyme. A considerable excess of the simple thiols is required for complete protection.

The results obtained on intracorneal iodoacetate in our cases agree with this concept of enzymatic inhibition. However, maleic anhydride belongs to the same class of inhibitors; but the clinical results for this chemical failed to show that sulfhydryl was beneficial in any way. It would be interesting to assay the treatment of a lesion caused by maleic anhydride injected intracorneally.

Winter and Tullius[31] found that a minute amount of the powdered maleic anhydride was extremely irritating and produced long-lasting damage with vascularization of the rabbit cornea. In our studies, we were not impressed by the severity of reaction of maleic anhydride even up to a 10-percent solution. The lesions appeared no more marked than corneal lesions from 0.5 cc. of a 0.25N HCl solution.

Vascularization of the rabbit cornea appears to be readily induced by the various noxious substances delivered to the cornea. We were impressed with the observation that pronounced corneal vascularization often began in four or five days in the rabbit. This appears more rapid than one would expect in a human cornea burned to the same degree.

Cogan[32] has observed that there appears to be a significant relationship between swelling of the cornea and neovascular formation in the stroma of the cornea. "Neovasculogenesis" occurs only when the corneal stroma adjacent to the preexisting vessels swells. Moreover, deturgescence in itself may be responsible for the subsequent collapse and partial obliteration of the blood vessels.

The presence of corneal edema following acid burns to the cornea has been fully described.[26] Since the rabbit cornea is considerably thinner than the human cornea, it seems likely that the former will be more reactive and that there will be more corneal edema following the chemical agent than in the human.

Stained histologic sections of normal human and rabbit corneas have been measured microscopically. The human corneal epithelium and Bowman's membrane measure 45.4 and 8.4 μ, respectively, compared to 33.6 and 1.75 μ for the corresponding structures in the rabbit eye (Carpenter and Smyth[24]).

Although these figures do not represent in vivo dimensions they illustrate the relative difference. It follows that, if the rabbit cornea reacts with relatively more edema, neovasculogenesis should proceed at a more rapid rate. This would coincide with the observation on early vascularization of the cornea.

The only other known (unpublished) work on the experimental evaluation of Hydrosulphosol for corneal burns was done by Carpenter and Moses[33] at the Mellon Institute for Industrial Research. They report that the compound was not effective in hastening the healing process after corneal burns. They describe their results as follows:

> Both eyes of anesthetized rabbits were burned either with 0.005 ml. amounts of 10 percent NaOH, 0.005 ml. of undiluted amine 220E, or with 0.25 ml. of a 5 percent dilution of toluene in propylene glycol. One eye of each rabbit was selected as a no treatment control and the other received a 1:19 dilution of Hydrosulphosol concentrate in castor oil five minutes after inflicting the burn and every 30 minutes thereafter for a total of eight applications. These eyes were stained with fluorescein and examined three hours after the injury and after the elapse of 1, 2, 7, and 14 days. During this 14-day period, at no time were the treated eyes in macroscopically better condition than the untreated control eye of the same animal. Therefore we discontinued this study after using three pairs of eyes on each compound. Admittedly these burns were quite

severe, as in each case the three-hour examination revealed necrosis and opacity of a major portion of the cornea.

One other experience with small controlled burns confirmed this opinion. Multiple corneal burns were made with six percent NaOH on both eyes of 20 rabbits using a capillary pipette technique capable of producing uniform lesions. One eye of each rabbit was treated with 1:19 Hydrosulphosol in castor oil three times daily for four days. The eyes of each animal were examined daily during the course of treatment and at three-day intervals thereafter for six weeks. No changes were noted in the rate of healing or the end results in either the treated or untreated eyes. Prior to the above experiments it was demonstrated by instillation of an excess of each compound into five rabbit eyes that the 1:19 dilution of concentrate, the aqueous solution, and the ointment caused no damage to rabbit eyes detectable with fluorescein staining 24 hours after the instillation.

Carpenter is of the opinion "that clinical observation of human eye burns treated with Hydrosulphosol will have to be relied upon to correctly evaluate the therapeutic efficiency of this compound."

In the recorded literature, Hydrosulphosol has always been considered a nontoxic compound and no untoward reactions have been mentioned. Ross[34] describes a case of epithelial dystrophy in which Hydrosulphosol (five percent) in castor oil was used in the right eye, the left eye being maintained as a control. A severe inflammatory reaction developed after using the sulfur compound for three days. The process gradually receded following cessation of the drops. Patch tests were negative to castor oil, mildly positive to Hydrosulphosol in castor oil, and severely positive to sulfur.

I have seen nothing to resemble this either in the rabbits' eyes or in the human cases that have been treated. However, allergy to sulfur must be considered in the same fashion as allergy to all therapeutic agents.

Summary and Conclusions

1. The successful clinical results claimed for sulfhydryl as found in Hydrosulphosol are interesting and require controlled investigation. Reports in the literature on Hydrosulphosol for human ocular burns due to strong acids, alkalies, anhydrides, and detergents are very favorable. In the absence of any controlled experiments to support these claims, a series of studies has been undertaken to determine if results in laboratory animals matched clinical impressions.

2. The physicochemical properties and the pharmacology of Hydrosulphosol were described. Sulfhydryl as found in this compound is regarded as the active constituent for the treatment of chemical eye burns.

3. The methodologic problems for the production of standard lesions and the use of a grading system for the measurement of the severity of ocular lesions have been considered and discussed.

4. A total of 157 rabbit eyes were tested with various chemical agents including strong acids, strong alkalies, anhydrides, and specific agents designed for enzyme inhibition.

5. Results in 53 paired rabbits' eyes in which corneal lesions were produced with various chemicals showed that the use of Hydrosulphosol in treatment is neither superior nor inferior to the controlled eye in which no treatment was used. With only one chemical, iodoacetate, was Hydrosulphosol in three paired experiments consistently better than the controlled untreated eye.

6. The observation on iodoacetate was in accord with its known enzyme-inhibiting properties and specific protein denaturant qualities. However, maleic anhydride, which belongs to the same selective inhibiting class of agents, showed no difference in the response to Hydrosulphosol medication, which is theoretically capable of delivering an excess of sulfhydryl ions to the tissue.

7. The principal physiopathologic effects and differences between acid and alkali burns have been given. The use of sulfhydryl in these lesions followed the expected pattern; it was not surprising that its use proved to be a matter of indifference. It would seem logical that the chief sphere of activity for sulfhydryl would be in lesions produced by specific enzyme-inhibiting agents which com-

bine chemically with the SH— radical.

8. Caution must be expressed in any attempt to convert results in animal experiments to the clinical evaluation in human subjects. Further studies along the lines of specific chemical lesions should be considered for further evaluation of this compound.

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APPENDIX

Hydrosulphosol experiments
(Hydrosulphosol = SH)

No.	Chemical Agent	Method	Result	Duration of Treatment (in days)	Best Final Lesion*
1	0.5N HCl	0.5 cc. on filter paper	SH better	8	C.U. (rabbit dead)
2	0.24N HCl	0.5 cc. on filter paper	Same	6	H.S.
3	0.25N HCl	0.5 cc. on filter paper	SH better	9	Cured
4	0.25N HCl	0.5 cc. on filter paper	SH better	8	Cured
5	0.25N HCl	0.5 cc. on filter paper	Same	8	H.S.
6	0.25N HCl	0.5 cc. on filter paper	Same	7	H.S.
7	0.25N HCl	0.5 cc. on filter paper	Same	9	H.S.
8	0.25N HCl	0.5 cc. on filter paper	Same	7	H.S.
9	0.25N HCl	0.5 cc. on filter paper	Same	6	H.S.
10	0.25N HCl	0.5 cc. on filter paper	Same	8	H.S.
11	0.25N HCl	0.5 cc. on filter paper	Same	22	H.S.
12	0.25N HCl	0.5 cc. on filter paper	Control better	9	H.S.
13	0.25N HCl	0.5 cc. on filter paper	Control better than castor oil	6	Cured
14	0.25N HCl	0.5 cc. on filter paper	Castor oil better than control	14	Cured
15	0.25N HCl	0.5 cc. on filter paper	SH same as castor oil	15	H.S.
16	1N HCl	Splash-air jet 0.0047 cc.	Same	7	Cured
17	1N HCl	Splash-air jet 0.0047 cc.	Same	12	H.S.
18	1N HCl	Splash-air jet 0.0047 cc.	Control better	7	Cured
19	1N HCl	Splash-air jet 0.0047 cc.	Same	7	Cured
20	1N HCl	Splash-air jet 0.0047 cc.	Same	7	Cured
21	1N HCl	Splash-air jet 0.0047 cc.	Same	5	C.U. (rabbit dead)
22	1N HCl	Splash-air jet 0.0047 cc.	SH same as castor oil	6	Cured
23	1N HCl	Splash-air jet 0.0047 cc.	SH same as castor oil	6	Cured
24	1N HCl	Splash-air jet 0.0047 cc.	Control and BAL same	4	Cured
25	1N HCl	Splash-air jet 0.0047 cc.	Control and BAL same	5	Cured
26	1% NaOH	Splash-air jet 0.0047 cc.	Control better	6	Cured
27	1% NaOH	Splash-air jet 0.0047 cc.	Same	4	C.U. (rabbit dead)
28	1% NaOH	Splash-air jet 0.0047 cc.	Same	4	C.U. (rabbit dead)
29	1% NaOH	Splash-air jet 0.0047 cc.	Same	15	H.S.
30	1% NaOH	Splash-air jet 0.0047 cc.	Same	4	Cured
31	1% NaOH	Splash-air jet 0.0047 cc.	Control better	6	Cured
32	5% maleic anhydride	Splash-air jet 2×0.0047 cc.	Same	5	Cured
33	5% maleic anhydride	Splash-air jet 2×0.0047 cc.	Control better	6	Cured
34	5% maleic anhydride	Splash-air jet 2×0.0047 cc.	Same	6	Cured
35	5% maleic anhydride	Splash-air jet 2×0.0047 cc.	Same	6	Cured
36	5% maleic anhydride	Splash-air jet 2×0.0047 cc.	SH better	4	Cured

APPENDIX—(*continued*)

No.	Chemical Agent	Method	Result	Duration of Treatment (in days)	Best Final Lesion*
37	10% maleic anhydride	Splash-air jet 0.0047 cc.	Control better	4	Cured
38	10% maleic anhydride	Splash-air jet 0.0047 cc.	SH better	4	Cured
39	26% maleic anhydride	Splash-air jet 0.0047 cc.	Same	7	Cured
40	25% maleic anhydride	Splash-air jet 0.0047 cc.	Same	18	H.S.
41	0.33 M acetic acid	Splash-air jet 0.0047 cc.	Same	4	C.U. (rabbit dead)
42	0.33 M acetic acid	Splash-air jet 0.0047 cc.	Control better	7	Cured
43	0.33 M acetic acid	Splash-air jet 0.0047 cc.	Control better	7	Cured
44	0.33 M acetic acid	Intracorneal injection 0.1 cc.	Same	7	H.S.
45	0.01 M iodoacetate	Splash-air jet 0.0047 cc.	Same	3	Conjunctivitis†
46	1 M iodoacetate	Splash-air jet 0.0047 cc.	Same	3	Conjunctivitis†
47	0.001 M iodoacetate	Intracorneal injection 0.02 cc.	SH better	4	Cured‡
48	0.001 M iodoacetate	Intracorneal injection 0.02 cc.	SH better	12	H.S.
49	0.001 M iodoacetate	Intracorneal injection 0.02 cc.	SH better	8	Cured
50	1% H_2SO_4	Splash-air jet 0.0047 cc.	Same	4	Cured
51	1% H_2SO_4	Splash-air jet 0.0047 cc.	Same	4	Cured
52	1% H_2SO_4	Splash-air jet 0.0047 cc.	SH better	4	Cured
53	1% H_2SO_4	Splash-air jet 0.0047 cc.	Same	5	Cured
54	33% Cresol	Splash-air jet 0.06 cc.	SH better	6	Cured
55	33% Cresol	Splash-air jet 0.06 cc.	Control better	21	Cured
56	Conc. Cresol	Splash-air jet 0.06 cc.	Same	14	H.S.
57	Conc. Lactic Acid	Splash-air jet 0.06 cc.	Same	7	H.S.
58	Conc. Lactic Acid	Splash-air jet 0.06 cc.	Same	7	H.S.
59	50% Lactic Acid	Splash-air jet 0.06 cc.	Same	14	H.S.
60	CaO	Direct application 0.01g. powder	Same	7	Cured
61	CaO	Direct application 0.01g. powder	Same	7	Cured

* Key to Lesions: Cornea cured: Cured; Corneal ulcer: C.U.; Healed scar: H.S.
† Minimal lesions (no corneal lesion) but marked conjunctivitis.
‡ Control not well in 14 days.

EMBRYONIC INTRA-EPITHELIAL CYST OF THE CILIARY PROCESSES*

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Chicago, Illinois

It is the purpose of this paper to present a case of spontaneous cyst of the iris and to suggest an embryologic mode of its formation.

Cysts of the iris may be divided into several types: (1) Traumatic cysts which occur after accidental injury or surgery to the eye. (2) Spontaneous cysts which have no external etiologic cause. These spontaneous cysts may be divided into (a) cysts that occur in the iris stroma and (b) between the two epithelial layers, as intra-epithelial cysts.[2a]

This second type of spontaneous cysts is the one under discussion. They lie on the posterior surface of the iris or in the ciliary region between the pigmented layer of the iris and the iris proper. This condition has been recognized and described for many years but the etiology has been the subject of considerable controversy. At a recent meeting of this society a series of cases was presented by Dr. Algernon Reese,[1] and in the paper he states, "I have no explanation as to why these cysts occur." It was during the discussion of this paper that one of us (D. V.) suggested that the zonule could pull on the ciliary epithelium and separate the potential space between the two layers of the secondary optic cup to form the cyst.

CASE REPORT

The patient, a student nurse aged 21 years, was first examined (D. V.) on November 5, 1940. She was referred for consultation by Dr. Nancy Finney of Cincinnati, Ohio, who had discovered a peculiar pigmented elevated lesion lying in or under the iris stroma on the temporal side of the left eye.

A flat, firm lip of a light brown pigmented lesion could be seen attached to the anterior lens capsule at the three-o'clock position. When the pupil was dilated, it peeped out from under the pupil margin. When the pupil was contracted, a corresponding bulge or elevation of the iris could be seen, extending as far as the iris root. Ocular tension and the vision were normal. Transillumination was doubtful. A presumable diagnosis of melanoma of the iris was made, but it was considered wise to keep the patient under observation for a time before removal of the eye in order to make the diagnosis more certain.

Accordingly the lesion was studied at frequent intervals. On January 10, 1941, the angle of the anterior chamber was seen to be completely obliterated (gonioscopic examination) between the three- and four-o'clock positions and the lesion had increased in size. The ocular tension was normal, and no change was seen in the intraocular media. On January 22, 1941, the elevation of the iris at the root was higher and extended from the two- to four-o'clock positions. It was visibly touching the posterior part of the cornea at the limbus. There seemed to be some superficial atrophy of the iris in the affected zone and some pigment dissemination on the posterior surface of the cornea. Transillumination gave no further information. The ocular tension was normal. Enucleation was advised and was performed by Dr. Nancy Finney on January 26, 1941.

PATHOLOGIC REPORT

The specimen was sent to the ophthalmologic laboratory of the Holmes Hospital, Cincinnati, Ohio. The following examination and report are by Dr. Mary Knight Asbury, pathologist of the laboratory:

"The globe is normal in shape and appearance. The anterior-posterior diameter (fixed

* From the Department of Ophthalmology, Northwestern University Medical School. Presented at the 87th annual meeting of the American Ophthalmological Society, White Sulphur Springs, West Virginia, June, 1951.

† By invitation.

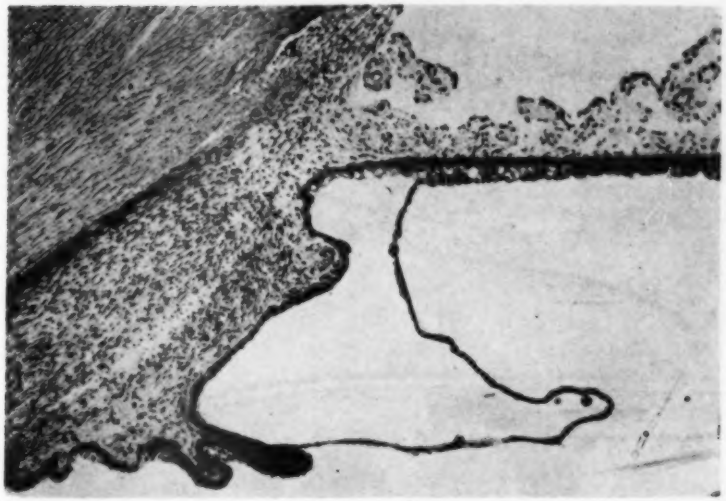

Fig. 1 (Vail and Merz). Microscopic section of the cyst developed between two layers of the pigmented epithelium of the iris.

specimen) measures 24 mm., equatorial diameters 23.5 mm. to 24 mm. The sclera is slightly bluish. The cornea is clear although the epithelium has been roughened. The anterior chamber is of normal depth, the pupil round, five mm. in diameter. Possibly the temporal side of the iris is raised slightly or thickened. The iris is gray, the markings distinct.

"The specimen was opened in the horizontal plane. The vitreous is clear, normal in consistency. The lens and retina are in place. From behind no gross abnormality could be seen in the ciliary region.

"*Microscopic.* Except for the anterior uvea, and in particular the epithelium thereof, the microscopic appearance of the eye is essentially negative.

"Multiple cysts of the ciliary epithelium have distorted the ciliary processes. A larger cyst arises from the middle third of the iris on the temporal side, and has developed between the two layers of the pigmented iris epithelium (fig. 1). In its greatest diameter the iris cyst extends to the pupillary border, and smaller cysts on its lateral wall reach into the angle between the root of the iris and the ciliary processes. The posterior wall of the large cyst is extensively adherent to the anterior lens capsule (fig. 2).

"The iris epithelium is deeply pigmented and was difficult to decolorize, but when accomplished, the cyst wall was seen to be made of a single layer of cells. There is no inflammatory reaction in the iris stroma or ciliary body. Several groups of large heavily pigmented clump cells are present in the iris stroma.

"Rapid growth of a heavily pigmented mass on the posterior surface of the iris, visible through the dilated pupil, made the clinical diagnosis of malignant melanoma, and enucleation seemed advisable. Microscopically the changes do not appear to be malignant, but the extensive and rapid cyst formation would soon have led to increased intraocular tension and visual loss.

"*Pathologic diagnosis.* Multiple cysts of iris and ciliary epithelium."

Dr. Bertha A. Klien, ophthalmic pathologist at Northwestern University Medical School, kindly reviewed the sections and was in complete accord with the above report. She added that on the nasal side the pro-

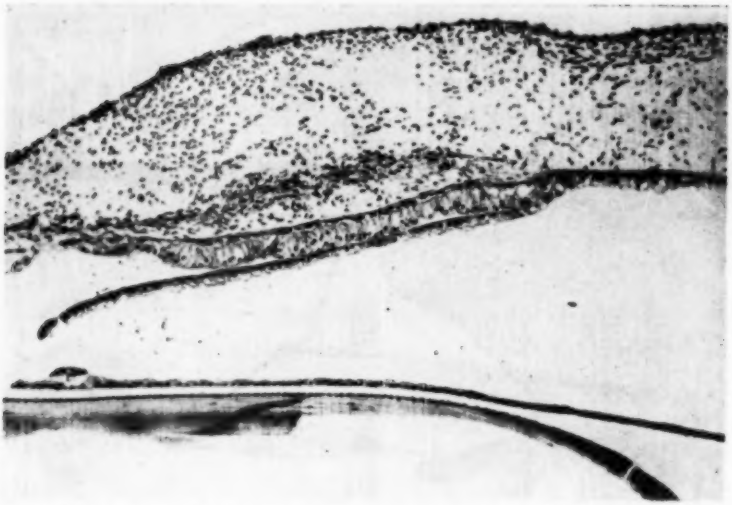

Fig. 2 (Vail and Merz). The posterior wall of the cyst adherent to the anterior lens capsule.

liferation and tendency to cyst formation extends to the pars ciliaris retinae, where strands of proliferated cells, partly adherent to the larger cysts have pulled some of the ciliary processes inward (fig. 3).

Review of the literature

In looking into the literature one is impressed with the amount of work and study done on this subject and the various theories advanced. In 1890, Treacher Collins[2] reported a case and believed the etiology to be an iridocyclitis, or other infectious process, causing an adhesion between the ciliary processes and the lens capsule, and retraction had pulled off the epithelium to form the cysts. Falchi[3] in 1896, Schieck[4] in 1904, and Bickerton[5] in 1907 also presented cases and agreed with this etiology. A second possible cause was presented by Coats[6] in 1907, when he presented a case. He was of the opinion the cysts were due to choroiditis causing the adhesion of the ends or tips of the ciliary processes to each other and to the lens to form a cyst. The third theory was advanced by Gilbert[7] in 1910, Gallemaerts[8] and Wintersteiner[9] in 1906, who believed the cause to be insufficient agglutination of the ring sinus of Von Szily.

Later, in 1910, Pagenstecher[10] advanced the theory that the cause was a proliferation of pigmented epithelium with a subsequent development of a lumen. Tersch[11] in 1914 published an article listing many of the theories then recognized and advanced his own theory that aberrant ciliary processes became adherent to themselves and to the iris to form cysts.

Juselius[12] and Blobner[13] believed that the ectodermal cells in the iris remained in their immature embryonic form throughout the fetal period but in later life were stimulated to grow and form cystic tumors. Loewenstein and Foster[14] were of the opinion that an intrauterine uveitis could cause synechias that would pull the two layers apart. Hanssen[15] in 1918 wrote that the anterior wall of the cyst arose from deformed dilator cells of the iris. Nadel[16] believes that ectodermal cells could migrate from the lens to the iris or ciliary body and become implanted, later developing into implantation cysts. Katzin[17] believes the cysts are due to incomplete closure of the annular sinus.

Embryology

We are interested in the stages of embryology beginning at the 48-mm. or seven-

Fig. 3 (Vail and Merz). The ciliary processes pulled inward by traction during cyst formation.

week stage. But a brief résumé of earlier stages may refresh our memory and make later stages more clear. For our basic information we refer to Ida Mann's book.[18]

The eye begins as an outpouching of the cephalic end of the central nervous system as early as the four-mm. or three-week stage. This neural ectodermal growth forms what is known as the *primary optic vesicle*. As the primary optic vesicle approaches the surface ectoderm at the 5.5-mm. stage it is thought to stimulate the surface ectoderm to increased growth to form the lens. As the lens develops the neural ectoderm indents or invaginates at the distal portion of the vesicle so that eventually the distal portion approximates the medial portion. Now we have a double-layered optic cup instead of a single-layered optic vesicle (fig. 4). Later the outer layer of the secondary optic cup becomes pigmented and forms the retinal pigment layer; the inner layer of the optic cup remains unpigmented and forms the retina proper. The lens develops from the surface ectoderm, completely separates from it, and comes to lie in the opening or mouth of the secondary optic cup.

Figures 5 to 8 illustrate the stages of development directly concerned with our problem.

At the 48-mm. or seven-week stage (fig. 5) the two layers of the invaginated optic cup are advancing forward around the large lens. The outer pigmented layer is separated from the inner nonpigmented layer by a space, the inner layer is seen to form folds and invagination from the overgrowth of tissue. This is the beginning of the ciliary body. No zonular fibers can be seen. The

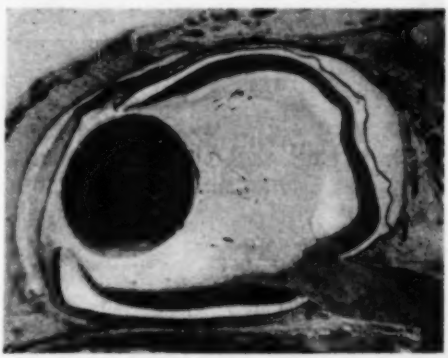

Fig. 4 (Vail and Merz). Double-layered optic cup of the 48-mm. stage. (Haden, H.: Tr. Am. Ophth. Soc., 39:41, 1941.[19])

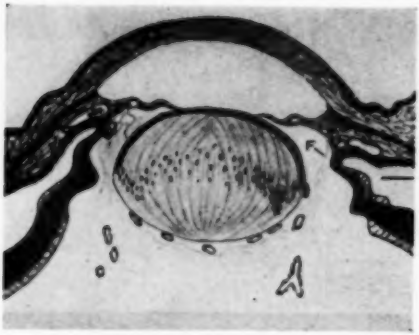

Fig. 5 (Vail and Merz). Human embryo of the 48-mm. or seven-week stage. (Mann, I.: Development of the Human Eye. Cambridge, The University Press.)

anterior rim of the cup approximates the lens.

At the 65-mm. or nine-week stage (fig. 6) the ciliary body has become more definite. The early zonular fibers can be seen to originate from the inner layer of the optic cup as processes from the ectodermal cells and to grow toward the lens surface. There seems to be some disagreement as to the exact mode of formation for the zonule. We agree in this controversy with Ida Mann[18] and Henry Haden,[19] who believe the zonule is entirely ectodermal in origin and develops from the inner layer of the optic cup, and do not agree with De Jean,[20] who believes it is mesodermal and develops from the primary vitreous. Drualt's bundle, which is crossed at right angles by the zonular fibers, now begins to disappear. The rim of the cup is advanced forward on the surface of the lens and still approximates it. Ciliary processes are forming. The space between the two layers of the optic cup is still open.

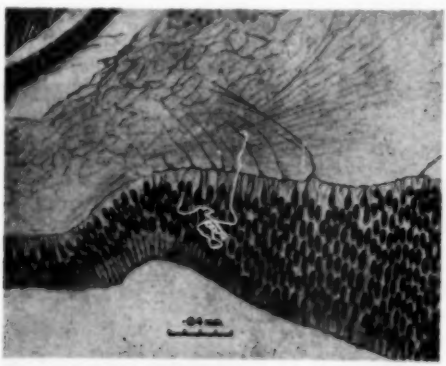

Fig. 6 (Vail and Merz). Human embryo of the 65-mm. or nine-week stage, showing the development of the zonular fibers. (Mann, I.: Development of the Human Eye. Cambridge, The University Press.)

At the 110-mm. or four-month stage (fig. 7) the zonular fibers can be seen to reach the lens. These fibers have formed a definite anterior and posterior layer. The ciliary folds and ciliary body are well developed and are in close contact with the equator of the lens. The rudimentary iris is growing forward over, and in contact with, the anterior surface of the lens. The two layers of the optic cup have become approximated and the space between them has been obliterated. No adhesion is noted between these two layers, however. At the tip of the optic cup this space is still open as the marginal sinus of Szily.

The zonular membranes, both anterior and posterior, are relatively short and tough at this stage. In the fresh preparation one can notice how closely the ciliary processes approximate the lens. However, fixation, which is the usual method of study, with its shrinkage and distortion, shows a separation of the processes from the lens. In later stages the ciliary processes and the zonule lie posteriorly, closer to the pars plana, but in some specimens examined at this time the processes have been found on the posterior surface of the iris (Gartner [28, 29]).

It is also noted at this time that the zonules originate from the lateral surface of the ciliary processes and in the depth of the valleys. This point again seems to have caused a controversy. We are in agreement with Troncoso[21] and Goldsmith,[22] and do not agree with Eggers,[23] who believes no zonular fibers insert on ciliary processes but all run through the valley posteriorly and insert in orbiculus ciliaris. It is apparent that the fibers insert more anteriorly in the ciliary process region and to the base of the iris in

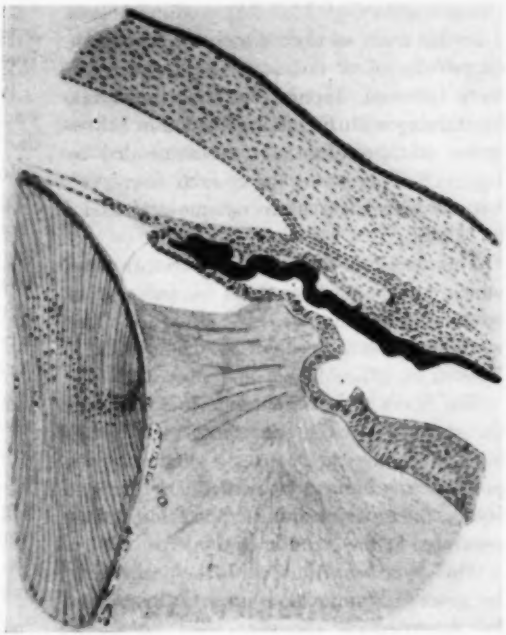

Fig. 7 (Vail and Merz). Human embryo of four-month stage with the zonular membrane reaching the lens. (Fixation and preservation cause the separation of the membranes as shown.)

the embryonic stages, and more posteriorly, near the ora serrata, in the adult. None of them is found to originate from the tips of the processes. This is significant, because all the cysts we have examined have likewise formed in between the processes and from the valleys. None of the cysts have involved the tips.

The last stage discussed is the five-month or 150-mm. stage (fig. 8). By this time the portion of the eye in which we are interested is almost completely developed, and closely resembles the adult stage. The iris has grown forward over the anterior portion of the lens and the ciliary processes have developed more posteriorly. The zonules are very well developed and the marginal sinus of Szily is closed. Here again we note that the zonular fibers originate in the valleys or lateral surfaces of the ciliary processes.

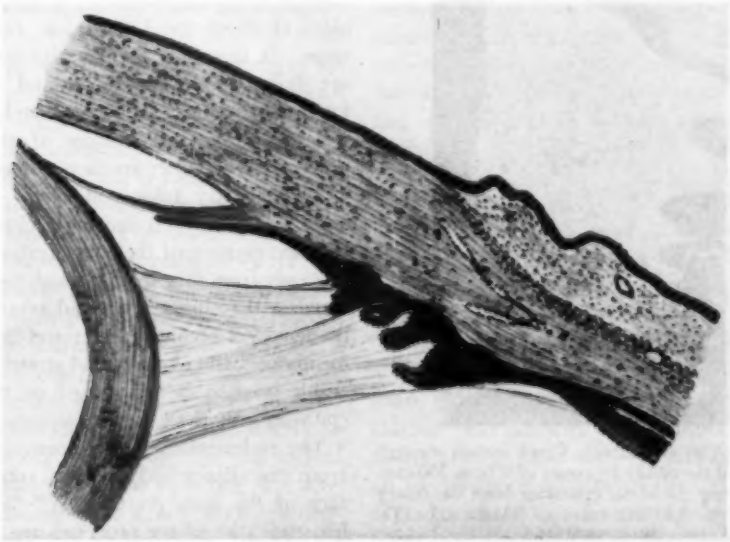

Fig. 8 (Vail and Merz). Human embryo of the 150-mm. or five-month stage. (The zonular membrane appears as in the mature stage.)

Anatomy

In the study of the anatomy of the zonule the works of Troncoso[21] and Goldsmith[22] were followed. Troncoso studied the zonule by staining with Flemming's solution (chromium acetic-osmium) as recommended by Eggers.[23] This stains the zonular fibers yellow, making them more opaque and easier to follow.

The zonule is a continuous membrane on which run the zonular fibers bound together by an interfibrillar cement substance. This work has been verified by Duke-Elder,[24] Beauvieux,[25] Loddoni,[26] and Moreno.[27]

The fibers are the anatomic foundation of the structure, while the transcement which binds them together causes a single traction pull for mechanical power. There are two layers, the anterior and the posterior, widely separated at the equator of the lens.

The space between them is the perilenticular space of Hannover. It is vertically crossed by intermediate strands called equatorial fibers. The anterior zonular layer is inserted into the anterior lens capsule in front of the equator of the lens and the posterior zonular layer is inserted behind the equator.

The fibers run from the lens to the upper one third of the processes, where they meet and become inserted into the slopes on each side of the processes.[21] None of them insert into the heads of the processes. The fibers from the anterior and posterior layers join at the insertion and run together at the bottom of the valleys, finally spreading out and inserting near the ora serrata. Some fibers run from the orbiculus to the sides of the heads of the processes and some from one head to another. Some fibers even seem to proceed into the vitreous.

Goldsmith[22] states that the zonular fibers are prismatic in shape and have a marked stretching ability. The anterior sheath of the zonular membrane is much the stronger of the two and therefore has greater traction pull than the posterior. This is important also in the study of the accommodation which takes place in later life.

Fig. 9 (Vail and Merz). Cross section through the lens and the ciliary processes of a fetus 350-mm. long, showing the fibrils extending from the ciliary epithelium to the lens capsule. (Haden, H.: Tr. Am. Ophth. Soc., 39:41-48, 1941.)

Discussion

It is our opinion that the cysts under discussion are embryologic in origin and take place at about the 110-mm. or four-month stage. At this time the zonular membranes are fully developed, short, and relatively tough. They run from the lens surface to the valleys and lateral surfaces of the ciliary processes where they are firmly attached (fig. 9). The ciliary folds and ciliary body are quite well developed and lie in close contact with the equator of the lens. As development proceeds from this stage onward, the distance between the ciliary body and processes and the lens will become greater and the zonular membranes will elongate and stretch. Considerable traction is maintained on the ciliary epithelium of the ciliary processes.

The rudimentary iris is growing forward from the ciliary body on the anterior surface of the lens. As Gartner[28,29] shows in his study, the ciliary processes are also pres-

ent at the base of the iris or even on the posterior surface of the iris. Later these normally disappear from the iris but can be found not infrequently as anomalies. The space between the two layers of the optic cup is just obliterated, but there are no adhesions between these layers.

Any undue traction or pull by the zonules on the inner layer of the cup could readily reopen the space between the two layers and allow cyst formation. As shown above, the pull would be on the inner layer of the cup in the depth of the valleys and on the lateral walls, and at this stage running from the base of the iris almost completely to the pars plana. The slides of the cysts reported show that the cysts do form from the base of the iris to the pars plana. One slide from the case presented (fig. 2) shows a definite adhesion between the lens capsule and the epithelial layer of the optic cup. This seems to be a firm union with no evidence of choroiditis or inflammation to account for the adhesion. Therefore, the best explanation for the formation of the cyst appears to be the one advanced above.

A thorough and complete anatomic study was followed along the lines advocated by Troncoso[21] in 1936 and 1942, in which fresh material was used and dissected instead of using histologic slides alone. It is very difficult to follow the zonular membrane in serial sections, because many slides must be reviewed and the continuity thus is lost.

In our investigation it was thought best to begin on animal eyes and determine their zonular structure. Pig embryos were obtained and after studying several at different age levels with poor results it was decided to change to bovine fetuses.

A mature cow's eyes were obtained first and one eye was dissected from the anterior surface, removing cornea and sclera down to the ciliary body. The second eye was incised at the equator, vitreous removed, and lens with attachments left intact. Both eye segments were then stained with Flemming's solution and the zonular membranes studied.

Following this, calf fetuses were obtained of 350-mm., 210-mm., 170-mm. and 90-mm. (head-tail) size. The most mature were studied first, progressing to the most immature, so the structures could be more easily identified.

One eye in each case was dissected grossly and studied and the other eye placed in celloidin and sectioned. Our studies agreed and verified the work done by Troncoso on animals. The anatomy and development are as stated above.

Then a study was made on human fetuses obtained through the courtesy of Dr. Tresley and Dr. Alpern at Cook County Hospital in Chicago.

The stages obtained were 250-mm. (head-rump), 150-mm., 90-mm., and 65-mm. Similar studies were conducted on these eyes. Here again we agree with Ida Mann, Henry Haden, and Uribe Troncoso as to the origin, embryology, and anatomy of the zonule or suspensory ligament and are not in thorough agreement with De Jean and Eggers.

Our observations seemed to show that the zonular membranes are definite membranes consisting of fibers with cement substance between the fibers. They insert in the valleys of the ciliary processes up to the base of the iris. They are obviously tough, and on traction can be seen to distort the surface of the lens.

Conclusion

The conclusion arrived at is that these cysts form in the valleys of the ciliary processes in fetal life at about the 110-mm. stage by traction of the zonule of Zinn on the posterior epithelial layer of the secondary optic cup, thus separating the potential space that is present there. At this stage, as Gartner has shown, ciliary processes are found arising from the base and not rarely on the posterior surface of the iris in close contact with the lens. Extremely short zonule fibers may form and adhere to the lens cap-

sule. They may remain small and symptomless and unnoticed or develop into large cysts requiring removal of the eye. It is thought that the constant working of the zonule during accommodation may act as a mechanical irritant later in life and thus increase the size of the cysts.

700 North Michigan Avenue (11).
55 East Washington Street (2).

We are grateful to Dr. Ida Mann and the Cambridge University Press for permission to reproduce Figures 5 and 6, and to Dr. Henry Haden and the Tr. Am. Ophth. Soc. for the use of Figures 4 and 9.

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POSTERIOR EXUDATIVE IRITIS*

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New York

The most common cause of acute exudative iritis is infection that occurs as a complication of injuries and operations. Clinically and pathologically these two types are very similar. However, in infections after operations the antibiotics seem to act more effectively than after injuries.

When the primary infection is in front of the iris, the exudative plasma and cells move forward—anterior exudative iritis; and when—back of the iris, they move in that direction—posterior exudative iritis, in accordance with the law of chemotaxis.

The exudative iritis that is ordinarily dealt with involves chiefly the anterior layers of the iris, where its course can be observed clinically, much of it even with the naked eye. The flare in the anterior chamber, seen with the slitlamp in the early stages, is due to increased albuminous content in the aqueous.

Under the microscope, the normal anterior chamber appears to be empty but, when albumin is excessive in the aqueous, the chamber takes on an intensely red color. The existence of fibrin in an albuminous aqueous is seldom mentioned in reports of slitlamp examinations. It is fibrin that supports the cellular elements and is the ground work of membranes, especially at the pupillary border.

The yellowish discoloration and indistinct markings of a spongy swollen iris are due to myriads of polynuclear cells that pass through the vessel walls into the stroma. Most of the cells migrate into the anterior chamber and are caught in a fine network of fibrin.

Some may sink down and form a hypopyon. Ordinarily polymorphonuclear leukocytes make up a hypopyon as with a serpiginous ulcer, but very exceptionally the cells may be mononuclear as when a less toxic phlyctenular ulcer leads to a hypopyon. As the greatest rarity a majority of the cells may be eosinophils.

That the pus cells are not retained under the anterior layer of the iris and there produce a very dense infiltration or an abscess is probably due to the ease with which they can penetrate the poorly developed anterior limiting layer which is interrupted by numerous large and small crypts that dip deeply and widely into its stroma.

Clinically, posterior exudative iritis runs through its active stage unrecognized, being concealed under the anterior layers of the iris.

Histologically one of its earliest signs is the appearance of a cell-free albuminous fluid and fibrin in the aqueous of the posterior chamber, which is analogous to what happens in the anterior chamber at a corresponding stage of anterior uveitis. However, the striking histologic difference between the two is that, posteriorly, the thick and compact pigment epithelium of the iris offers a stronger barrier to the passage of fluid and cells than does the thinner porous anterior limiting layer. The histologic findings, illustrated in Figures 1 through 4 are given in verification of this statement.

Figure 1 represents a globe enucleated because of late infection. The partial detachment of the pigment epithelium by a fluid rich in albumin and fibrin shows that the stream in the iris flowed backward and, since it could not pass through the pigment layer, it pressed it away from the stroma and detached it.

Figure 2 illustrates an eye after injury complicated by endophthalmitis and secondary glaucoma. The process has gone a

* Read at the meeting of the IV Pan-American Congress of Ophthalmology, Mexico City, January 8, 1952.

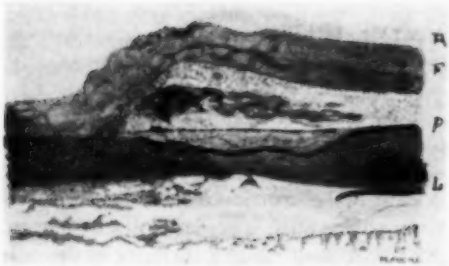


Fig. 1 (Samuels). A globe enucleated because of late infection. (A) Aqueous containing excessive amount of fibrin. (F) Fibrinous exudate, with a few pus cells covering iris. (P) Pigment epithelium detached by albuminous fluid. (L) Lens capsule separated by pus from the pigment epithelium.

step beyond that in Figure 1. Here a broad compact ribbonlike gathering of pus cells is ready to break through the iris but is retained by the pigment epithelium so that only a few cells have escaped.

Figure 3 is from a case of leukoma adherens with late infection. Here the pigment epithelium is detached in the form of arcades by fluid and pus cells.

Figure 4 shows a very severe endophthalmitis septica with a large vitreous abscess.

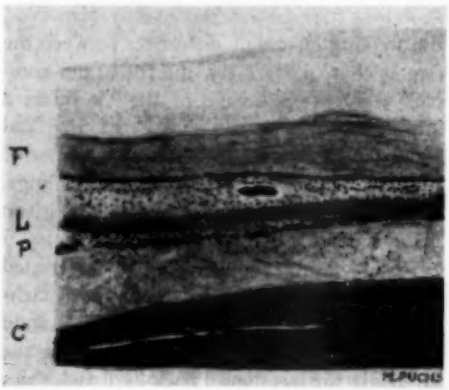


Fig. 2 (Samuels). A case of injury with endophthalmitis and secondary glaucoma. (F) A fibrinous coagulum with a few pus cells covering iris. (L) Broad band of pus anterior to dehiscent pigment epithelium. (P) Detached pigment epithelium. To the left, oblong pigmented cells may be proliferated fibers of the dilatator muscle. Lens capsule (C) separated from iris by albuminous fluid.

Here the ciliary processes are also producing pus. The disintegrating pigment epithelium has permitted a wholesale escape of a compact mass of pus over a broad area.

Types of cells in posterior exudative iritis

In anterior purulent iritis, it is the rule to find in the iris and chamber polymorphonuclear leukocytes quite unmixed with other cells. In the fluid medium of the chamber the cells soon begin to swell and the nuclei to break up, due to the necrobiosis.

The point is that in posterior exudative iritis, lymphocytes are apt to be encountered among the leukocytes and at times in no inconsiderable number. In Figure 2, by high power, scattered among the pus cells are many lymphocytes and there is also a large number of oblong cells which apparently are a proliferation of the cells of the dilatator muscle. Proliferation of the dilatator cells is not infrequent in cases of posterior purulent iritis but it forms no important part in its early stages.

In explanation of the absence of lymphocytes in the exudate of anterior exudative iritis and of their presence in posterior exudative iritis it is recalled that the iris is near the seat of the primary infection in the anterior chamber so that the toxins come in contact with the stroma through its thin anterior layer and its open spaces, little diluted, and are therefore potent enough to excite the diapedesis of polymorphonuclear leukocytes to the exclusion of other types.

In posterior exudative iritis the focus of infection is in the vitreous cavity and consequently at a longer distance from the iris so that they must be diluted by the time they reach the iris. Then, too, it would seem that the pigment epithelium acts, to a certain extent, as a barrier to the ingress of toxins into the iris just as it does to the egress of fluid and cells from the iris.

This property of the pigment epithelium to protect the iris from toxins in the posterior chamber resembles that ascribed to the

retina in protecting the choroid from the toxins of an infected vitreous, even though the internal surface of the retina be plastered with pus cells. A few pus cells may be found in the pigment layer but probably none in the choroid, especially if the retina is detached.

It is near the ora serrata and the papilla, where the choroid is not protected by the retina, that one may find lymphocytes in

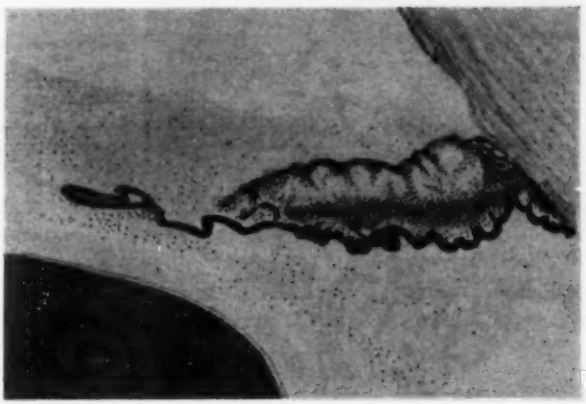
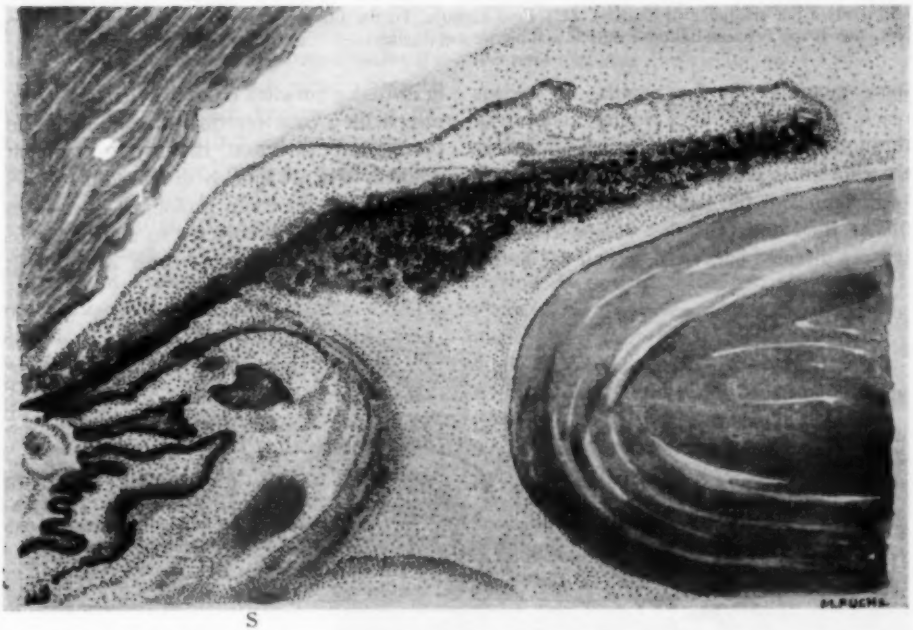


Fig. 3 (Samuels). A case of leukoma adherens with late infection. The pigment epithelium is detached in arcades and separated by albuminous fluid from a broad band of pus which occupies the deep layers of the iris.



R

S

Fig. 4 (Samuels). Severe endophthalmitis septica with a large vitreous abscess. The epithelial layers are destroyed over the ciliary processes (S). In the recesses between the processes (R) the epithelial layers are preserved. The band of pus cells back of the iris is far broader than that over the destroyed pigment epithelium.

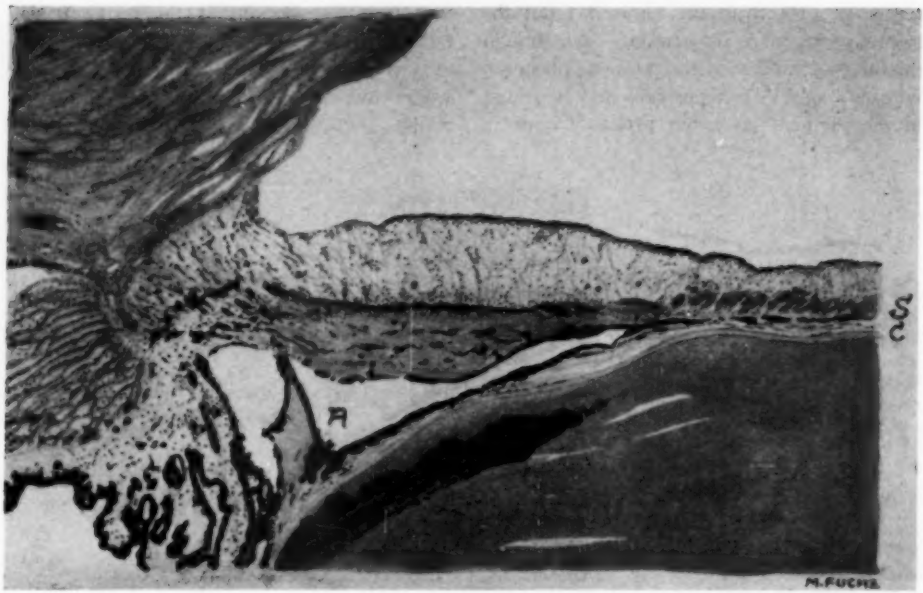


Fig. 5 (Samuels). Atrophy of globe caused by intraocular cysticercus. (A) Triangular artefact. (S) Drawn out sphincter of the iris. (C) Lens capsule. To the far left darkly stained deposits of lime. Note membrane between dilatator muscle and pigment epithelium.

some quantity. At the papilla, the toxins reach the choroid in a round about way through the tissue of the nervehead, where the choroid is not protected by the pigment epithelium and the lamina vitrea.

The fluid and cells that escape from the iris are directed backward so that the toxins in diffusing forward from the vitreous cavity meet with a counteracting stream moving in the opposite direction. Because the pigment epithelium is not quickly dissolved it follows that there is a certain prolonged interval in which the iris is subjected to a stimulus of relatively low intensity, which of itself is

Fig. 6 (Samuels). A case of abscess in vitreous body. Total posterior synechia with increased depth of angle of anterior chamber.

conducive to the production of lymphocytes and fibroblasts among the overwhelming number of polymorphonuclear leukocytes.

Sequelae of posterior exudative iritis

In the milder cases that have gone no further than the detachment of the pigment epithelium from the dilatator muscle (fig. 1), the albuminous and fibrinous exudate in the space so formed becomes organized into a dense connective tissue (fig. 5). In the severer cases the exudate may break through the pigment epithelium in spots (fig. 2) or over a broad surface (fig. 4), and the adhesions formed between the iris and the lens and the ciliary processes in the course of organization and contraction vary in extent accordingly. It may be that only a few tags of connective tissue extend backward (fig. 6) but these are enough to draw the periphery of the iris into the circumlental space and make the increased depth at the angle clinically very noticeable.

Analogous to the inflammatory detachment of the iris (fig. 1), there is another type in which toxins originate exclusively in the vitreous body and affect the most posterior layers of the iris. In Figure 6 an intraocular cysticercus caused atrophy of the eyeball. The stroma of the iris is little changed aside from the adhesion at the angle. Reference to Figure 1 will show the initial albuminous and fibrinous stage of the dense membrane that here fills out the triangular space between the dilatator muscle and the detached retina.

In ordinary acute endogenous iritis, there is little or no exudation into the posterior chamber to organize and for this reason the periphery of the anterior chamber does not become deeper.

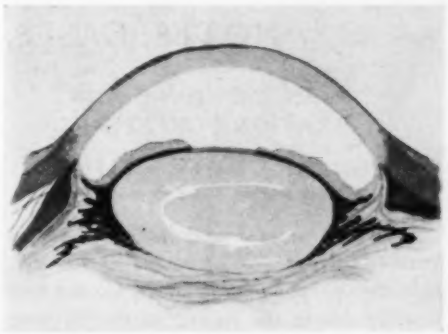


Fig. 7 (Samuels). (Drawing from Fuchs's *Diseases of the Eye:* Brown.) Total posterior synechia causing the periphery of the anterior chamber to be greatly deepened and rounded.

The posterior chamber in sympathetic ophthalmia and Vogt-Koyanagi's disease bears a resemblance to that in acute exudative iritis but the content is not a true exudate; rather it is a granulation tissue formed by the iris which advances against the lens and into the circumlental space.

Summary

Posterior exudative iritis is a condition that is not very rare. It happens when toxins from the posterior chamber irritate the iris on that side and cause an exudation in the deep layers of the iris and into the chamber. During the second, third, and fourth weeks after an injury or operation, which is the period of organization and contraction of the exudate (fig. 7), special attention should be paid to the depth of the periphery of the anterior chamber. Its increased depth may be the first sign, aside from failing vision, of a badly infected vitreous cavity.

57 West 57th Street.

NOTES, CASES, INSTRUMENTS

AN IMPROVED FIXATION FORCEPS*

WILLIAM J. HARRISON, M.D.
Philadelphia, Pennsylvania

I have at times found that the average fixation forceps for immobilizing the eye, as in the operation for cataract, has not held securely due to the tearing of the conjunctiva at the "bite" line with the resultant loss of fixation.

To overcome this difficulty, I have designed a pair of forceps without teeth. The "biting" portions of the forceps are fashioned to fit the normal curvature of the globe and are composed of a male and female blade. They give a secure and adequate "bite."

135 South 17th Street.

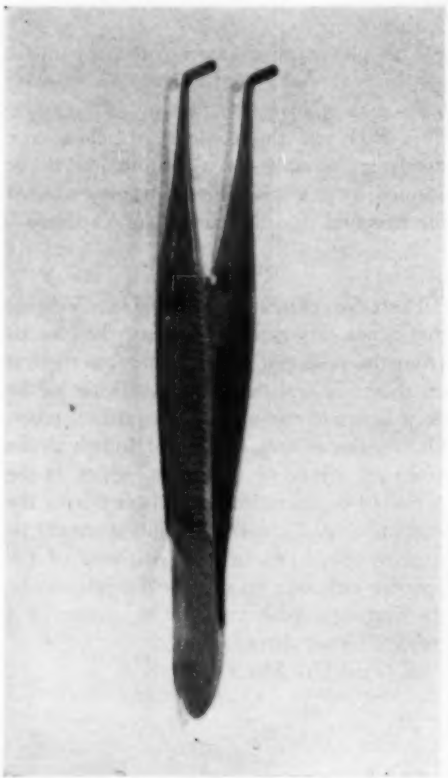


Fig. 1 (Harrison). An improved fixation forceps.

*This instrument may be obtained from the E. B. Meyrowitz Surgical Instruments Co., Inc., 520 Fifth Avenue, New York 18, New York.

A SIMPLE AID FOR FUSION

BERNARD M. TESCHNER, M.D.
New York

The use of a child's toy as an aid for fusion is presented because of its economy, attractiveness, and ease of adaptation. The Viewmaster* is a toy that shows colored stereoscopic pictures of various subjects and is designed especially for children.

It consists of a set of viewing prisms fronted by a pane of frosted glass (fig. 1). The light source is extraneous. The target is a disc containing seven pairs of colored stereopictures which are rotated into view by pressing a small lever at the side of the box.

I have used this toy (1) to test for fusion

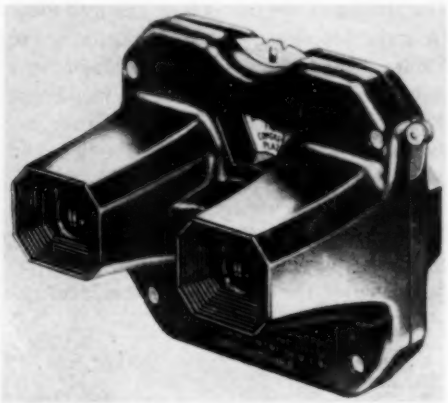


Fig. 1 (Teschner). The Viewmaster, a simple aid for fusion.

*The Viewmaster is made by Sawyer's, Inc., Portland, Oregon.

and stereopsis; (2) for home training for fusion; (3) for children with marked monocular dominance and/or beginning amblyopia whose squint is purely accommodative and who are rendered orthophoric with corrective lenses.

The only addition necessary is a cross made with a fine pen and ink. The cross is so drawn that the upright bar is on one picture and the cross bar is on the other picture of the stereogram. One must use some degree of accuracy; that is, use the same point on each picture for the center of the cross.

The patient can easily determine if he is using two eyes when he sees the cross floating in front of the stereogram. He is directed to locate and look at the cross first and then gaze into various portions of the depths of the stereogram. The amount of time used for exercises per day depends on the severity of the underlying fusional loss.

The Viewmaster is recommended because of its simplicity, economy, and attractiveness, especially for children, who do not object to being trained on this instrument which has Hopalong Cassidy and Roy Rogers for targets.

880 Fifth Avenue (21).

MAJOR MODIFICATION OF THE KERATOME*

ALAN L. ROWLAND, M.D.
San Diego, California

Probably no cutting instrument is used more in ophthalmic surgery than the keratome. Its universal use in initially penetrating the anterior segment of the globe in almost all of the more common intraocular procedures, such as iridectomy, iridencleisis, and cataract extraction, warrants further improvement in its design.

Especially is this true in the use of the keratome in cataract extraction. It has seemed to me that more and more the technique in cataract extraction is returning, with fewer modifications than one would at first think possible after two centuries, to the original method of Daviel, who used a knife to initiate the incision and then enlarged the section with scissors.

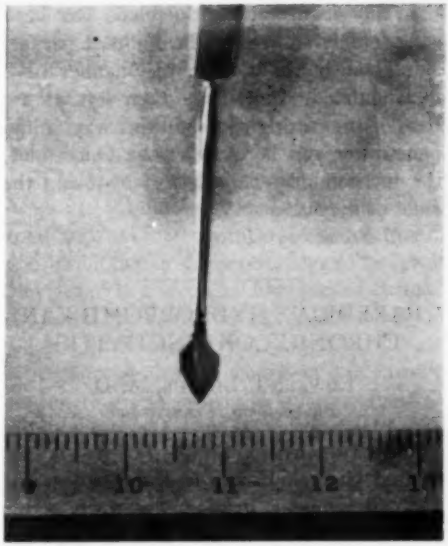


Fig. 1 (Rowland). The modified keratome.

For the original incision, the keratome has generally seemed more satisfactory; however, I have found that the broad angle of the classical keratome makes initial penetration more difficult and somewhat less controlled. The Graefe knife requires practically no force in initiating an incision and is thus better controlled.

I have tried, therefore, to devise an instrument employing the combined advantages of both the knife and the keratome. For the acute angle I started with the Agnew keratome but this instrument had the disadvantage that the angle of the point was still somewhat broader than necessary and that it was too long, thus endangering the posterior surface of the cornea and the anterior surface of the lens. Its length also seems to cause it to catch the iris on its tip more than does the classical keratome.

* The keratome is manufactured by the Storz Instrument Company, Saint Louis.

In my modification, the blade has been considerably shortened. Two almost parallel sides, which are used in the manner of a nonangulated knife, have been left at the base of the cutting edges. In this way, initial penetration can be made easily. Once done, the incision may be enlarged by using the sides of the blade.

625 Broadway (1).

PAREDRINE HYDROBROMIDE IN CHRONIC CONJUNCTIVITIS*

EDWARD I. LIPSIUS, M. D.
Philadelphia, Pennsylvania

Paredrine hydrobromide (P-hydroxy-A-methyl phenethylamine hydrobromide) is a sympathomimetic drug whose main action consists of vasoconstriction and mydriasis when used locally in the eye and which, when taken by mouth, produces a pressor effect, with increased systolic and diastolic pressure, without change in cardiac output, pulmonary circulation time, vital capacity, basal metabolic rate, and respiratory dynamics.[1] It has been used in ophthalmology mainly as a mydriatic when little or no cycloplegic effect was desired.

While using one-percent paredrine hydrobromide ophthalmic with boric acid for mydriasis, patients frequently stated that the drops made their eyes feel better. It was noted that, in addition to the pupillary dilatation, the palpebral conjunctiva was pale and the small blood vessels of the bulbar conjunctiva were invisible, or practically so, although the large blood vessels were visible. It was felt that, if a dilution of paredrine hydrobromide could be found which would cause vasoconstriction but not mydriasis, we would have a serviceable therapeutic agent. It was not felt that the boric acid in the solution produced the feeling of well being in the eyes.

According to the manufacturers the minimal mydriatic response will occur at 0.15-percent paredrine hydrobromide concentration. Therefore, 0.1-percent paredrine was used. This produced mild vasoconstriction, but no pupillary dilatation, grossly. When 0.1-percent paredrine was used in only one eye of the subject, there was no difference found in the size of the pupils and the response to light was the same in each eye. There was no increase of intraocular pressure in any case.

One of the disadvantages of any vasoconstrictive drug is the possibility of absorption, with systemic pressure effect and increase of blood pressure. Local nasal use of 1.0-percent paredrine hydrobromide has been common, with no reports of increase of blood pressure. This concentration is 10 times that used in this study. However, Korne and Randall,[2] and other investigators have successfully used paredrine intravenously and intramuscularly in large doses for the purpose of raising blood pressure.

We, therefore, tested 25 patients with conjunctival blood-vessel dilatation by instilling one drop of 0.1-percent paredrine in each eye, and checking the blood pressure before and 10 and 20 minutes after instillation. No tendency to increase blood pressure was shown, although some of these patients had hypertension, nor was there any subjective feeling of increased blood pressure.

The question arises as to why paredrine hydrobromide should have a favorable action on the inflamed conjunctiva. Inflammation is a reaction to other stimuli besides infection. With inflammation goes vasodilatation and stasis and the attending discomfort of edematous tissue. As long as an infection or an irritation is present the inflammation is a useful thing.

Nature's reactions are, however, frequently overgenerous. Thus, in the healing of wounds, excessive granulations or fibrous tissue may be produced causing proud flesh and keloids. In healing broken bones, excessive callus may be formed. Instead of cells

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* From the Wills Hospital and the Albert Einstein Medical Center, Eastern Division.

dividing orderly they may divide excessively, as in malignancy. If one's skin is sensitive, mere stroking can cause redness as can be seen in dermographia.

The nature of allergies is much debated but it represents excessive or perverted reactions to stimuli. Williams[3] considers allergy an autonomic dysfunction expressed by vasomotor changes, consisting of arteriolar spasm with atonic dilatation of the capillaries and venules. The point being emphasized here is that nature is not always perfect in her reactions.

There are many explanations of why refractive errors produce chronic conjunctivitis and probably the best is simply that rubbing eyes produces irritation, infection, and inflammation. Added to the redness and vasodilatation in chronic conjunctivitis is the swelling of the bulbar conjunctiva and, in older persons, the relaxation of the bulbar conjunctiva, which often folds up before the closing lid, so that it is certainly irritated. Even after an initial irritant has been removed, it is possible for the effect of the irritation to continue.

Paredrine is used only as an adjunct to treatment; not as a substitute for an etiologic search. Patients with chronic conjunctivitis should be refracted and have studies of smears, scrapings, and cultures of the conjunctiva, lids, and lacrimal sac. This should include irrigation of the lacrimal sac.

If pathogenic organisms are found the appropriate antibiotics or antiseptics should be used and, even if organisms are not found, the antibiotics or antiseptics should be tried. Thygeson[4] in a series of 200 cases of chronic conjunctivitis could find no organisms in 38 percent of the cases.

A thorough history is important in chronic conjunctivitis to determine whether there is an allergic, environmental, or seasonal factor involved. The lids should be examined for verruca or molluscum contagiosum, and it must be determined that the tear secretion is adequate.

It is in cases, especially in older people, in which no definite cause can be found but the eye is still chronically red and inflamed that the use of 0.1-percent paredrine hydrobromide is indicated. The purpose is not to produce profound or continuous vasodilatation, but to aid the vasomotor mechanism in com-

TABLE 1

RESULTS IN USE OF PAREDRINE

Patient	Age	Sex	Occupation	Probable Etiology	Associated Pathology	Bacteriology	Other Treatment	Results in Eye Treated with Paredrine
M. B.	(years) 73	F	Housewife	Relaxed bulbar conjunctiva	None	Neg.	None	Markedly Improved
S. G.	66	M	Scrap metal sorter	Exposure to dust	Pingueculae of both eyes	Staph. albus	5% Sod. sulfadiazine sol.	Unimproved
L. G.	48	M	Driver	Exposure to wind and sun	None	Neg.	None	Slightly improved
A. A.	37	M	Executive	Unknown	Pinguecula of left eye	Neg.	None	Markedly improved
L. R.	75	F	Housewife	Relaxed bulbar conjunctiva	None	Neg.	None	Markedly improved

batting stasis and edema. The vasoconstriction comes on in three to five minutes and lasts about one hour. There is no secondary vasodilatation. Paredrine may also have a favorable action by producing slight shrinkage of the bulbar conjunctiva although this is difficult to evaluate.

Paredrine hydrobromide is somewhat unstable at pH values above 6.0 and therefore is prepared in a two-percent boric-acid solution. A suggested formula is: 25 minims of one-percent paredrine hydrobromide ophthalmic solution; 5.0 gr. boric acid; normal saline to make four drams; dosage, two drops every three hours.

Appropriate antibiotics or antiseptics may be prescribed separately. The alkaline antiseptic salts cannot be used in the same solution with paredrine hydrobromide, since they cause the pH to go above 6.0.

An attempt was made to evaluate the use of 0.1-percent paredrine by treating the left eye with the paredrine in boric-acid solution and the right eye with boric-acid solution alone. There were only five cases (table 1) in which the treatment was consistently carried out by the patients and the drugs were used separately in each eye as directed. Of the five cases, three were markedly improved in the eye treated with paredrine compared to the untreated eye.

Summary

1. Paredrine hydrobromide ophthalmic (0.1 percent) is an aid in treatment of chronic conjunctivitis, especially in old persons. It produces vasoconstriction and probably combats stasis and edema.

2. It does not produce mydriasis, increased intraocular pressure, or increase of blood pressure when used in 0.1 percent strength. It does not result in secondary vasodilatation.

5918 Larchwood Avenue (43).

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EXTENSIVE CORNEAL EROSION DUE TO SHAVING LOTION

NORMAN B. YOURISH, CAPT. (MC), U.S.A.
Camp Rucker, Alabama

A 29-year-old officer was referred to the eye clinic because of a painful, red, right eye of three hours' duration. He stated that he had never had any eye disease of any sort until that morning. While shaving, he accidentally squirted a small amount of a popular shaving lotion into his right eye. It caused a slight stinging and he attempted to wash it out at once. The eye felt better for a short time, but then began to ache and burn. Vision became blurry.

Examination revealed vision of 20/60, O.D., and 20/20, O.S. Findings in the left eye were entirely negative. The right eyelid was edematous, covering about half of the cornea. There was marked photophobia and pain on separating the lids.

After instilling pontocaine, the cornea was examined and was seen to be almost completely denuded of epithelium. A gray irregular cuff of epithelium could be seen encircling the limbus. The entire corneal surface stained deeply and evenly with fluorescein except near the limbus.

The eye was irrigated thoroughly with saline. Atropine drops and sulfacetamide ointment were instilled and a firm pressure

dressing applied. This was left intact for 48 hours, then re-applied for another 24 hours.

Examination on the third day revealed an irregularly staining cornea, with a circumference of regenerating epithelium, three to four mm. inside the limbus.

The eye was again patched for 24 hours. On the following day the patient complained about irritation from the patch on his swollen hyperemic upper lid. At this time a complete layer of epithelium appeared to have formed over the entire cornea. A faint semicircular linear opacity was seen by slitlamp, as well as many small staining areas. He was placed in a darkened room on hot compresses, atropine, and 10-percent sulfacetamide solution. Irritability subsided rapidly and all further treatment was discontinued on the seventh day after the accident. When seen one week later, the pupil was returning to normal size, the cornea was transparent, and vision was 20/20, O.U.

Discussion

On inquiry by mail, the manufacturers replied that they had never before had a complaint. The main ingredients of the shaving lotion are alcohol and water (98 percent) with small amounts of perfume, menthol, glycerine, benzoic acid, and saccharin. It was the opinion of their chemist and consulting physician that the injury was due to the alcohol with possibly lesser effect from the glycerine.

It was of interest that the adverse effect was entirely limited to the epithelium. Use of a tight pressure dressing resulted in good regeneration with firm adherence to Bowman's membrane. There has been no evidence of recurrent erosion to date (six weeks). An antibiotic ointment was used, even though ointments are known to slow corneal epithelial regeneration, because it was considered most desirable to leave the pressure dressing in place for long periods without re-dressing the eye and eyelids.

Summary

A case is reported of complete denudation of the corneal epithelium caused by a preparation which is widely sold for use on the face after shaving and might readily come in contact with the eyes. Results of treatment were excellent.

EENT Clinic.

Ophthalmic Miniature

It has been asserted, with what degree of propriety the profession are to judge; that as inflammation of the conjunctiva, commonly called purulent Ophthalmia, in its simple and uncomplicated form, proceeds through its different stages to perfect recovery, unaided by any medical interference, we should refrain resolutely from any officious meddling with the disease, etc. Not long since, the profession witnessed the decay of the periodical wherein such doctrines were broached; and their promulgation now only proves that some persons have outlived all faith either in medicines or themselves.

W. R. Wilde,
London Journal of Medicine, 1851.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

December 3, 1951

DR. ADOLPH POSNER, *president*

THE MARK J. SCHOENBERG MEMORIAL LECTURE

NARROW-ANGLE GLAUCOMA

DR. PAUL A. CHANDLER (Boston) said that narrow-angle glaucoma is a form of glaucoma in which obstruction to outflow of aqueous is due solely to closure of the angle of the anterior chamber by contact between the periphery of the iris and the trabeculum. The filtration apparatus is normal. In wide-angle glaucoma, aqueous has access to the angle at all times, and obstruction to outflow is due to some fault of the filtration apparatus.

In some cases the narrow-angle (angle closure) mechanism may be superimposed on a type with defective filtration apparatus. The validity of the classification of primary glaucoma into the narrow-angle (angle closure) and wide-angle (open angle) types is supported by gonioscopy, clinical observations, and measurement of rate of aqueous outflow.

The principal anatomic factor in a shallow anterior chamber and a narrow-angle is a lens disproportionately large for the anterior segment of the eye. The principal physiologic factors, which in the presence of an anatomically shallow anterior chamber and narrow angle lead to closure of the angle and a rise in tension, are dilatation of the pupil and relative pupillary block or abnormal resistance to flow from posterior to anterior chamber. Accommodative effort and congestion of the uveal tract are considered to be less important factors. Closure of the angle may be temporary and reversible or permanent due to peripheral anterior synechias.

Evidence was presented indicating that relative pupillary block is probably the most essential factor. When it is eliminated by an opening in the periphery of the iris, the other factors can no longer bring about closure of the angle and a rise in tension.

Diagnosis of narrow-angle glaucoma is made by the history and clinical findings, principally gonioscopy, the tension curve, and measurement of aqueous outflow.

The typical clinical course of the acute and subacute or chronic forms of narrow-angle glaucoma was described.

The conventional medical treatment of acute narrow-angle glaucoma was outlined. For surgical treatment of the early cases or those in which tension can be lowered with miotics, peripheral iridectomy or iridotomy is recommended. For the more advanced stage, when the tension cannot be lowered with miotics, iridencleisis or modified basal iridectomy is advised. For the subacute and chronic form, the importance of complete control of the tension at all times is emphasized.

For surgical control peripheral iridotomy or iridectomy is advised for the early cases in which the disc is normal or cupping and field changes are minimal. For the more advanced cases a filtering operation is required, such as iridencleisis or cyclodialysis combined with peripheral iridectomy.

Bernard Kronenberg,
Recording Secretary.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

January 17, 1952

DR. GEORGE F. J. KELLY, *chairman*

SOME PHASES OF KERATOPLASTY

DR. R. TOWNLEY PATON (New York), the guest speaker gave:

1. A brief historic resume of the development of keratoplasty, beginning with Pellier's first description of attempting to make an artificial cornea out of glass in 1789.

2. The increasing incidence of success in corneal transplantations is due to: (a) Improved operative technique; (b) proper selection of cases; (c) pre- and postoperative treatment of corneal scars, in which vascularization is present, by radiotherapy.

3. A review of the operative results on 118 cases showed that there were 25 cases of Groenouw's dystrophy, 12 cases of Fuchs's dystrophy, 64 cases of keratoconus, and 17 cases of leukoma. The highest percentage of good results was obtained in keratoconus, then, in order of sequence, Groenouw's dystrophy, leukoma, and Fuchs's dystrophy. Interstitial keratitis and crucial scars from injuries and disease were not included in this series.

4. Five cases of bullous keratitis following cataract operation were markedly improved by lamellar transplantation, as well as two cases of herpetic ulcers.

POSTOPERATIVE COMPLICATIONS

DR. HAROLD G. SCHEIE discussed postoperative complications of keratoplasty and their treatment: I am unable to discuss adequately the portion of Dr. Paton's paper which is devoted to lamellar keratoplasty. Because of the rather limited number of patients in our clinic at the Hospital of the University of Pennsylvania for whom keratoplasty is indicated, it has been our practice to do either a penetrating keratoplasty or superficial keratectomy followed by penetrating keratoplasty. Lamellar keratoplasty, in the past, has been found by experience to give visual results which are inferior to the penetrating type. I have, therefore, been waiting for further evidence to suggest its use based on modern techniques, before taking up its use.

Discussion of a paper such as Dr. Paton's, which relates experiences with 65 patients operated for keratoconus alone, leaves no opportunity for amplification. I am in complete agreement that keratoconus gives the most favorable results, although the operation is technically more difficult to do than for many other conditions. In my own experience, however, interstitial keratitis, where scarring is mild and moderate, gives nearly as good results. We have not had as good results with nodular dystrophy as described by Dr. Paton and others.

Paton, Castroviejo, and others doing pioneer work have helped to establish keratoplasty as the sound surgical procedure which it is recognized to be today.

When divided into prognostic Groups 1 to 4, the outcome can be predicted with a fair degree of certainty. Groups 1 and 2, the most favorable groups, give results which are beginning to be comparable with the over-all results of cataract extraction. The operative procedure is little more difficult, although trouble, when encountered, is apt to be more irrevocable.

In 50 successive cases, I have had only two operative complications, the lens being injured in each. Extrusion of the graft rarely occurs, and postoperative complications are rare.

Anterior synechias are not uncommon postoperatively. We try to free them within two weeks after operation by making a small puncture with a knife-needle, through which the synechia is wiped away from the graft. The anterior chamber is then partially filled with air. If the synechia is allowed to continue for a longer time, the incidence of corneal edema and corneal opacity increases

because the corneal endothelium is prevented from sealing the inner aspect of the incision and aqueous is imbibed into the healing cornea.

We have had no postoperative infections of the wound itself or of the sutures, but we did lose one eye from a retrobulbar infection due to pyocyaneus. This could of course, have happened with any operative procedure.

In the same series of patients, one patient in Group 4 lost an eye as a result of corneal transplant surgery. This, however, was an instance where the patient had everything to gain and nothing to lose, the cornea being staphylomatous.

In some instances, however, even in Group 4 some of our most rewarding surgery is encountered. These patients usually have such poor vision that their condition cannot be made worse, and in many instances the final result is amazingly good.

A recent example is a patient examined by both Dr. Adler and me. We agreed that enucleation was probably in order for cosmetic reasons. The eye was divergent, the cornea was very densely scarred and leukomatous. We felt that it was edematous as well. However, following corneal transplantation using a seven-mm. graft, the vision improved to 6/7.5, where it has remained for a year postoperatively, and good fusion resulted, her eyes becoming straight. Such a dramatic result is of course very unusual, but we did have several other eyes in Group 4 in which the results were very gratifying.

In general our indications for surgery differ little from Dr. Paton's. As a rule we advise corneal transplantation only when the vision is 20/200 or less, and usually then only when the other eye also has defective vision. I would like to conclude by congratulating him upon the extent of his work, his beautiful results, and to compliment him for the many beautiful illustrations which he has shown.

Dr. R. Townley Paton (closing): I feel that one thing should be emphasized about keratoplasty in general, and this applies particularly to the younger men. We should keep in mind that most of the people in need of this type of surgery come from the clinic group of patients. There are relatively few of the wealthy group of patients who can be helped by keratoplasty. There are, however, many industrial accident cases; and also there is a group of patients who, because of inadequate treatment or complications following removal of foreign bodies, find that a corneal scar has resulted which markedly interferes with sight.

In order to obtain more operative cases, it is wise to let it be known in your community that these people may obtain surgery and sometimes free hospital care. In this way one can build up quite a large clinic.

I am very much interested in Dr. Scheie's discussion. His technique in doing the transplant must be excellent as he apparently does not have anterior synechias develop very often. Not all anterior synechias cause clouding of the grafts. Some of these had better be left alone unless the patient complains. Often with the contraction and dilatation of the pupil under various lighting conditions, a synechia may cause great discomfort. The smaller synechias may easily be cut with a needle-knife; the larger ones may have to be cut with scissors through a keratome incision. If the adhesion includes one third or more of the edge of the graft and the graft is cloudy, re-operation becomes necessary, and the old graft and the adherent portion of the iris are removed, and a fresh graft inserted.

M. Luther Kauffman,
Clerk.

OPHTHALMOLOGICAL SOCIETY OF MADRID

February 22, 1952

Dr. Marin-Amat, *presiding*

Pulsating exophthalmos

Dr. Mario Esteban presented a case of monolateral pulsating exophthalmos due to rupture of the carotid in the cavernous sinus of the left side. The patient, a woman, aged 53 years, had been hearing rhythmic and intense noises in the ear and in the head since the preceding September. At first the noises disturbed her a great deal, and even interfered with her sleep, but in the course of time she became used to them. There is no history of any injury or of violent strain, except that at times she held a child in her arms for three hours. Three months later, in December, the left eye began to protrude.

The patient showed a pronounced exophthalmos, direct and reducible, although not completely. Palpation elicited pulsations and a thrill. The veins could be felt like thick cords which pulsated violently especially in the upper inner angle of the orbit. Auscultation at the forehead, cheek, and temporal region gave whistling noises isochronous with the pulse. The pulsations and the blowing disappeared on compressing the carotid in the neck, but they became more pronounced on compressing the jugular.

The motility of the eye was unaffected and there was no diplopia in any part of the field. There was injection of the conjunctival and episcleral veins. In the fundus, the papilla seemed normal, the arteries were constricted, the veins dilated and pulsating. Ocular tension was raised to 55 mm. Hg (Schiøtz) (in the other eye it was 25 mm. Hg). Vision was normal, 6/6, and the visual field was normal.

This patient is now undergoing a complete study, embracing the general circulation, the arterial and venous pressure in the retina, angiographs and so on. After a complete study has been made, it will be possible to decide on the proper therapeutic measures. Of the two surgical methods usually applied in such cases—ligature of the veins in the rear of the orbit and ligature of the carotid in the neck—Dr. Esteban is partial to the second procedure. He preferred ligature of the common carotid to that of the internal; and even better yet, ligature of the common carotid and the internal carotid of the same side, which procedure is not only more efficacious, but also less dangerous, since it avoids the risk of spreading of the clot. This was the point he wished to stress which he had also discussed in several articles.

Iron foreign body

Dr. Marin-Amat presented the case of a laborer who had a large particle of iron in his eye with the following history. The particle hit his eye while he was cutting up firewood by striking against a stone with a pickaxe. The particle penetrated the upper lid, sclera, choroid, and retina, and lodged in the lower part of the vitreous in front of the equator.

There were several strands of fibrin stretching from the wound in the upper-inner quadrant of the eye to the lower portion of the vitreous which terminated in a coagulum of blood.

Vision was lost because of a violent chorioretinal reaction to the presence of the foreign body, which showed by a greenish discoloration of the iris (siderosis), in the eye for a period of 13 days.

Retinitis proliferans externa

Dr. Aguilar Munoz presented a 22-year-old man who had observed a gradual loss of vision in both eyes, though it started in the left eye. The fundus of the eye showed very broad striae, white with an iridescent luster, and with perfectly well-defined borders. These striae split at the ends and terminated at the periphery in small square projections. The vessels passed over them showing that they were situated in the external layers of the retina.

In the right eye there were more of these irregular masses, with more diffuse borders, but also situated in the external layers of the retina. After a differential diagnosis of exudative retinitis of Coats and retinitis of Hippel-Lindau, the diagnosis of retinitis proliferans externa was made and concurred in by several colleagues.

Siderosis bulbi

Dr. Aguilar Munoz also presented a patient whose eye was enucleated 13 days previously because of a foreign body with siderosis bulbi. A methylmetacrylate implant was used, tunneled in the manner of the Allen implant. A rectus muscle was introduced into each tunnel. These were sutured in pairs on the anterior surface of the implant and the hole was covered with conjunctiva.

Although only a few days had elapsed since the procedure, the cicatrix is in good condition, there is hardly any inflammatory reaction and no edema of the conjunctiva; the folds of the sac are large and allow ample motility for the stump. A model of the implant, made by Mr. Laiseca of the Auxiliary Service of the Provincial Hospital, was shown.

Corneal transplantations

Dr. Galindez Iglesias presented a case of total transplant of the cornea (10 mm. diameter) in extensive and dense corneal leu koma. The transparency of the graft is retained (now 18 days after the operation) and the eye is being treated with a cortisone collyrium. His second case was of keratoconus operated on two years previously with a circular transplant (6.5 mm. diameter). The transplant has remained transparent but the thinned-out cornea, peripheral to the graft, has developed a small conical cornea.

Rupture of ciliary arteries

Dr. Bartolozzi presented a paper on probable rupture of the short posterior ciliary arteries, and presented a case in which there was peripapillary choroidal atrophy, posttraumatic, which he attributed to a rupture of the finest arterial branches of the posterior ciliary arteries. He explained the probable pathogenic mechanism.

Discussion. Dr. Marin-Amat agreed with the diagnosis, saying that peripapillary choroidal atrophy is pathognomonic of absence of circulation in that region. The arborizations of the short posterior ciliary arteries nearest to the papilla resolve themselves into a continuous arterial network which supplies blood to the peripapillary zone of approximately the diameter of the papilla.

The choroidal arterioles of a second group do not participate directly in the formation of this first arterial network. They run straight, alongside the veins which form a tangled mass and which go to form a second network further forward up to the equatorial region.

The third zone of choroidal arterial blood supply (the most anterior) belongs to the recurrent arteries of Leber and comes from the major arterial circle of the iris.

The forward stretching of the eyeball as a result of trauma in the posterior region can explain the rupture of the fine branches of the short posterior ciliary arteries to which reference has been made. It may also be due in part to a torsion of the eye resulting from the trauma, as Dr. Bartolozzi has said.

Joseph I. Pascal,
Translator.

AMERICAN JOURNAL OF OPHTHALMOLOGY

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"A DREAM COMETH THROUGH A MULTITUDE OF BUSINESS"

The 57th annual session of the American Academy of Ophthalmology and Otolaryngology held in Chicago, October 12th to 17th, attracted nearly 5,500 members and guests. Each year it continues to grow in size, influence, and usefulness.

The guest-of-honor this year was Fletcher D. Woodward, M.D., otolaryngologist of Charlottesville, Virginia. His address, "The widening aspects of otolaryngology," was stimulating and witty, and it should have a most bracing effect upon the wilting spirits of our colleagues who have feared that their specialty was becoming moribund. "The king," said Woodward, "of tonsillectomy, mastoidectomy, and sinus surgery is dead! Long live the king of otology, allergy, nasal physiology, eradication of neoplastic disease, and many other things of modern scientific techniques applied to otolaryngology!"

The president, James Milton Robb, dis-

cussed the importance of a firm knowledge of pathology in one's daily work. The title of his address was "As is your pathology so is your practice."

After presenting honor keys to a number of teachers and instructors of the academy, Dr. Robb introduced Dr. Plinn Morse, pathologist, of Detroit, Michigan, who spoke on the "Role of pathology in eye, ear, nose, and throat practice." His associate, Dr. Fred Gerton of Detroit, then showed a number of interesting, illustrative cases, supplementing Dr. Morse's address.

The rest of the morning's program, under the direction of William L. Benedict, was devoted to a panel presentation of the fourth edition of the *Atlas of Ocular Pathology* and a preview of the forthcoming *Atlas of Otolaryngology,* both sponsored by the academy. The history, objectives, selection of material and illustrations, and development of the *Atlases* were briefly outlined by those who had played major roles in this affair.

These are Harris Mosher, Gen. G. R. Callender, Gen. Elbert DeCoursey, Col. J. F. Ash, Brittain F. Payne, Helenor Wilder, Muriel Raum, Jonas S. Friedenwald, and E. P. Fowler, Jr.

Dr. Benedict announced that Dr. Friedenwald had just returned from the Netherlands where he had given the Donders Lecture, his subject being "Diabetic retinopathy," and had received the Donders Medal. The prolonged applause that greeted this announcement was a manifestation of how much our members appreciated and respected this honor to our fellow American and colleague of great distinction in ophthalmology.

David G. Cogan of Boston gave the Jackson Memorial Lecture. His subject was "Congenital ocular apraxia." He presented a motion picture that convincingly demonstrated the evidence of this entity, new to most of us.

Harrington and Flocks reported on "Ophthalmoplegic migraine," and evolved the theory that this condition is due to a herniation of the uncus or hipocampal gyrus over the edge of the tentorium with pressure on the third nerve.

Thygeson and Hogan reported on a clinical and experimental study on the effect of cortisone and hydrocortisone in corneal ulcers. They showed that it had little or no effect on the bacterial diseases and would be harmful in the herpetic virus diseases of the cornea.

On October 15th, following an eloquent and moving tribute to our late and beloved member and ex-president of the academy, Walter B. Lancaster, by James Regan, a symposium on "Strabismus," under the able chairmanship of Kenneth C. Swan, was given to an audience that overfilled the hall. Those who took part in this sterling exhibition were Hermann Burian, Francis Adler, Harold Brown, Frank Costenbader, and C. Allen Dickey. The members of the panel, all widely known for their work in the field of ocular motility, had labored for almost two years to get the material together and, by most careful rehearsals, developed the program with exquisite precision.

Curtis D. Benton, Jr., and F. Phinizy Calhoun, Jr., of Atlanta, Georgia, reported on a catastrophe of methyl-alcohol poisoning, involving 320 persons. Their careful study of the general and ocular effects of poisoning with this substance will be of the utmost value to medicine. They pointed out that immediate intravenous treatment with alkaline fluids to combat the acidosis resulted in saving many lives and prevented much blindness. The thoughtful discussion by Albert Potts of Cleveland, whose experimental work on the effect and probable mode of action on the tissues of the eye by methyl alcohol is well known, served to complete the picture presented by the essayists and together formed one of the most important papers of the session.

Leonard Christensen and Edward McLean gave us startling evidence that accidental surgical injury to the lens in glaucoma

surgery was much more frequent than was generally supposed.

Michael Hogan talked on "Ocular toxoplasmosis," and showed that, by his investigations, a number of adult patients with uveitis have been observed in whom a diagnosis of probable toxoplasmosis can be made. He emphasized the importance of simultaneous serial studies of the titer with the methylene blue test of Sabin and the toxoplasmin skin test of H. A. Feldman. The discussion of this important paper by Feldman and by Helenor Campbell Wilder, who recently discovered the presence of organisms resembling toxoplasma in some forms of necrotizing chorioretinitis, enhanced the value of Hogan's paper.

W. Banks Anderson and Barnes Woodhall of Durham, North Carolina, in a remarkable paper showed conclusively that early neurosurgical treatment of congenital skull deformities (such as tower skull) associated with optic atrophy will result in striking benefit and prevent blindness. Harold Falls reviewed the subject of "Albinism," and added a great deal to our knowledge of this condition.

Adolph Posner and Abraham Schlossman gave further evidence of the disease entity first comprehensively described by them and known as the syndrome of glaucomatocyclitic crises. Their observations were confirmed in the discussions of this paper by Peter Kronfeld and Harold Scheie.

Mr. Harold Ridley of London gave to a packed house an exciting talk and motion-picture demonstration of his operation of substituting an acrylic (plastic) lens for a cataractous one. Derrick Vail in the discussion pleaded for conservatism in the use of this operation and asked that it be considered an experiment to be cautiously performed only by the most experienced and skillful surgeons until more is known and more time has elapsed.

Each scientific session was opened by a clinico-pathologic case report by various authors. These reports have become a most attractive and valuable contribution to the program. Alternating with the formal papers were excellent motion pictures by A. B. Reese, Wendell L. Hughes, Milton L. Berliner, A. E. Maumenee, R. Townley Paton, Brendan D. Leahey, Maurice Pearlman, and Max Fine.

Ten of the 29 scientific exhibits were of ophthalmic interest and it is pleasant to record that the exhibit "Hole formation in the peripheral retina," by C. C. Teng and H. M. Katzin received the first award.

The Section on Instruction treated us to 106 individual and 41 continuous courses in ophthalmology. The faculty was comprised of 187 instructors and the hours of instruction totalled 387. The rooms were crowded with eager pupils, many of whom were teachers themselves.

There were many auxiliary functions, as is customary. These included special programs of the teachers section, home study courses, industrial ophthalmology, orthoptics, allergy, motion pictures of the anatomy of the eye and orbit, plastic surgery, and, of course, the many delightful social events, formal and informal, so necessary for a happy background. These included the well-attended alumni dinners and the annual banquet at which Eddie Rickenbacker, Air-Force ace and Medal-of-Honor winner, gave an exciting and thoughtful talk on the subject, "It's not too late."

Frederick C. Cordes of San Francisco was elected president for 1953; John S. Shea of Memphis, president elect; Walter Theobald, first vice-president; Harvey Thorpe, second vice-president; Henry Orton, third vice-president; and S. Rodman Irvine, a councillor.

The 1953 meeting will be held in the Palmer House, Chicago, the second week in October.

Derrick Vail.

XVII INTERNATIONAL CONGRESS OF OPHTHALMOLOGY

September 13 through September 17, 1954
New York City
Waldorf-Astoria Hotel
Subjects for discussion: *Glaucoma* and *Uveitis*

CORRESPONDENCE

Antistine eyedrops

Editor,
American Journal of Ophthalmology:

This is with reference to the article "Palpebral dermatitis following use of antistine eyedrops," by J. L. Guerrant and W. C. Hollifield, American Journal of Ophthalmology, **34**:1318-1319 (Sept.) 1951.

This article, which has recently come to my attention, was read with considerable interest especially in view of a somewhat similar situation encountered in the Allergy Clinic of the Mercy Hospital.

A 32-year-old white woman was referred for consultation because of a palpebral and periorbital dermatitis of three weeks' duration. This proved to be a contact-type allergic dermatitis due to locally applied antistine ophthalmic solution, confirmed by positive patch tests. The eruption promptly subsided when this medication was discontinued. However, further patch tests proved her to be sensitive to the solution benzalkonium chloride contained in the antistine ophthalmic solution rather than to the antistine hydrochloride itself.

It is well established, as pointed out by the authors, that antihistaminic drugs when locally applied have occasionally proved to be sensitizing agents. However, information gained in a situation as herein described may often prove to be of importance to the ophthalmologist in arriving at an exact etiologic diagnosis: (1) So that the antihistaminic drug, if deemed necessary for the patient, may safely be prescribed in a different type of medium or base solution to which the patient is not sensitive, and (2) to avoid allergic reactions of cross sensitization in prescribing chemically related drugs.

(Signed) Sheldon G. Cohen, M.D.
Wilkes-Barre, Pennsylvania.

BOOK REVIEWS

The Significance of Heredity in Ophthalmology. A Tasmanian Survey. By J. Bruce Hamilton. Melbourne, Australia, A. H. Massina & Co., Pty. Ltd. (350 Swanston Street), 1951, edition 1. 135 pages, 27 pages of pedigrees. Price: 50 s.

In this book the author has summarized the data accumulated from a genetic survey of the ophthalmic pathologic processes present on the Island of Tasmania. Inhabited predominantly by Caucasians of British ancestry the island is a geographic division of the Commonwealth of Australia.

The incidence of inherited pathologic conditions of the eye in Tasmania was determined largely from three sources: (1) A busy private ophthalmic practice, (2) blind pensioners, and (3) a study of the students in the Sight-Saving School. The data are presented in easily visualized tabular forms. The sociologic, educational, and economic problems of the blind, as well as rehabilitation, are enumerated. Prevention of hereditary and other causes of blindness is energetically discussed and practical suggestions toward this end are made.

The author's survey includes the following ocular pathologic conditions: Cataracts (congenital, senile, and associated with dystrophia myotonica), coloboma of the iris, dacryocystitis, glaucoma, keratoconus, macular degeneration, angioid streaks, nystagmus, Leber's optic atrophy, pterygium, refractive errors, retinal detachment, retinitis pigmentosa, sarcoma of the choroid, and strabismus. The literature concerning each subject is briefly reviewed. The book concludes with a list of pedigrees which are of necessity

short. Many, unfortunately, depend upon hearsay evidence rather than the actual personal investigation of the author.

For the interested, and most ophthalmologists should be, the book will be a valuable addition to their library.

Harold F. Falls.

FUNDAMENTALS OF OPTICS. By F. A. Jenkins and H. E. White. New York, McGraw-Hill Book Company, Inc., 1950, edition 2. 647 pages, many figures and formulas. Price: $7.00.

The first edition of this book, so well known to physicists, was published in 1937. The authors are both professors of physics at the University of California. The second edition adds 10 chapters on geometric optics and a final chapter on the quantum behavior of light. The 13 years since this book first appeared have served to develop many new and important applications of old principles.

The textbook was originally designed for use in an advanced undergraduate course in optics, and it was assumed that the student had completed a thorough course in elementary physics and was familiar with the methods of calculus.

There are three parts: Part I, geometrical optics; Part II, physical optics; and Part III, quantum optics. In all there are 30 chapters, and at the end of each chapter are a number of problems to be solved. The correct answers are found at the end of the book. Many ophthalmologists will, therefore, get much profit and a great deal of intellectual fun out of solving—or at least trying to solve—these chapter questions.

For example: (1) A hollow prism of 60-degree angle, made with glass plates with parallel sides, is filled with carbon disulfide, index 1.759. Calculate the angle of minimum deviation. (2) A small artificial flower is embedded at the center of a glass sphere of 3.0-cm. radius. Find its apparent position and relative size, if the index is 1.50. (3) The end of a glass rod of index 1.60 is ground and polished with a convex spherical surface of radius 6.0 cm. Find the aplanatic points of this surface in air.

And more of the same, all good fun.

Derrick Vail.

TRANSACTIONS OF THE SOCIÉTÉ BELGE D'OPHTALMOLOGIE. 1951, No. 98, pp. 219-402.

A program of 21 papers was presented during the scientific meeting of the Société Belge d'Ophtalmologie on June 10, 1951.

A. Fritz discussed the direct observation and tonoscopy of the retinal capillaries with his especially designed method, in which a very bright light is restricted to a small field of observation. With this illumination the capillaries appear as connecting tubes of 300 microns between the arteries and veins. They are usually contracted in the middle of their course and dilated at their ends. This segmental narrowing disappears on vasodilation and is more pronounced in vasoconstriction. Capillaries are subject to pathologic changes such as varicosities and aneurysms. The pressure in the capillaries is measurable with an ophthalmodynamometer. The normal pressure is about 40 mm. Hg. If it falls below 17 mm. Hg, the danger of blindness is imminent. If it is moderately increased, retinal edema may occur; if it approaches 100 mm. Hg, hemorrhages and exudate appear in the retina.

C. Hoffman and J. Kluyskens described a 72-year-old man with bilateral compression of the optic nerve by atheromatous internal carotid arteries, causing signs and symptoms similar to fusiform aneurysms of this artery. The symptom-complex, recognized by A. Ley in fusiform aneurysm of the carotids, consists of optic atrophy in one eye, optic atrophy with papilledema in the other, characteristic field changes, and moderate arteriosclerosis. The diagnosis is made by surgical exploration. Early surgery is the only successful treatment.

J. François offered several useful sug-

gestions for the extraction of foreign bodies from the lens without increasing the localized opacities already present. These recommendations comprise maximal dilatation of the pupil, mobilization and extraction of the foreign body through the original capsule wound into the anterior chamber, and its removal thereupon through a keratome incision. The anterior chamber is irrigated with a solution of five drops of a 20-percent mechyl-choline solution in one cc. of physiologic saline solution. The miosis is maintained by instillation of DFP for several days with the aim of protecting the capsular wound from the imbibition of aqueous by temporary iris adhesions.

A fascinating paper on the chemotherapy of intraocular foreign bodies of copper was read by J. M. Habig, A. Lumen, and J. Snacker. They outlined their experiments on the conversion of copper salts into delicate insoluble particles that could be removed through phagocytosis. They also cite the history of an officer whose eyes were severely damaged by multiple intraocular shell fragments and who was treated, quite successfully, with intravenous and local solution of sodium hyposulfite. An injection of five cc. of 20-percent sodium-sulfite solution was given every 15 minutes until 10 gm. were given. At the same time a three-percent hyposulfite solution was instilled every 15 minutes into each eye.

M. Hartman emphasized the importance of psychosomatic factors in many ocular disabilities.

Several papers were devoted to abnormalities of the vertical muscles. G. Malbran summarized the functional changes of the vertical muscles in concomitant squint. Coppez offered a precise and concise review on the etiology of vertical diplopia. G. Sevrin and J. Collier revised their experience in the surgery of the oblique muscles. A. Franceschetti and H. Moutinho discussed the treatment of late and severe convergent squint in adults.

R. Weekers demonstrated his modifications of Blascovicz's ptosis operation cinematographically. This modification consists in the omission of the three sutures for the formation of the palprebral fold, a procedure which was not entirely approved in the discussion that followed.

M. Smeesters reported on a case of sympathetic ophthalmia successfully treated with intramuscular cortisone injections. A. Menier and R. Wiball confirmed the experience of other authors in their research work on cortisone in eye diseases. J. Appelmans, J. Michels and E. Van Assche treated two patients with keratoconjunctivitis sicca and severe rheumatoid polyarthritis of the spine with intramuscular cortisone injections and ACTH without improvement of the eye disease and only temporary relief of the arthritis.

R. Hermans provided useful information on the use of fluorescent light in ophthalmology. He emphasized the importance of the correct installation of this type of light in relation to the phases of the electric current, the windows present in the room, and types of tubes for the control of light intensity, diffusion, and transmission.

E. Prijot and R. Weekers measured the outflow of the aqueous under compression with the electronic tonometer and confirmed the fact of an increased resistance to the aqueous outflow in glaucoma.

J. Zanen and A. Menier illustrated the problems in the differential diagnosis of retrolental fibroplasia and persistence of the hyaloid vascular system.

P. Mathieu and J. Legros described a new symptom complex under the name of cat-scratch fever. It consists of a monocular severe hypertrophic conjunctivitis, preauricular lymphadenopathy, systemic disturbances, and a positive intradermal test to an antigen, prepared from aspirated pus. Detailed studies on a corresponding case confirmed the validity of a positive intradermal reaction and the presence of a

specific clinical entity, very similar to Parinaud's symptom complex.

J. François and M. Rabaey reported a case of massive preretinal hemosiderosis, following a preretinal hemorrhage, and apparently caused by a bleeding from an arteriovenous aneurysm. The localization in between the nerve fiber layer and the anterior limiting membrane, the presence of large, pigment-filled phagocytes, and the presence of iron pigment in the pigment epithelium are characteristic features; the separation of the anterior limiting membrane from Miller's fibers and its independent structure were distinctly visible in pathologic slides. The differential diagnosis between malignant intraocular tumor and the rare preretinal hemosiderosis is very difficult.

Alice R. Deutsch.

NEW MEANS OF STUDYING COLOR BLINDNESS AND NORMAL FOVEAL COLOR VISION. By Gordon L. Walls and Ravenna W. Matthews. Los Angeles, California, University of California Press, 1952. 172 pages, detailed bibliography. Price: $2.50.

New findings of fundamental significance issue from a fresh approach to the problems of color vision. The authors present also a penetrating analysis of all past work in this field, including the most recent, with the authority derived from extensive personal investigation. They firmly hold to the concept that the causes of protanopia and protanomaly are histologic (loss or under supply of red receptors) while those of deuteranopia and deuteranomaly are chemical (partial or complete blending of redness and greenness into undissociable yellowness).

Their special interest in Maxwell's spot—the heart of the present research—apparently followed the demonstration by Miles that the fixation point of the retina was always located within it. They use his purple filter (Wratten 2389) mounted alongside a neutral filter (Wratten 96). The subject looks alternately through the filters at an opalescent light box, two meters distant. Conclusive proof is submitted that the Maxwell spot does not result from the yellow pigmentation of the macula but reflects the pattern of receptor-type distribution. A typical color-normal sees through the purple filter an archery-type target (about 3.0 degrees in extent) containing a central reddish spot (0.5 degrees in average diameter), surrounded by a relatively wide clearing, followed by a broad pink halo vignetting into an almost white background. The picture fades rapidly; on switching the attention then to the neutral filter the central spot is seen in bright green; and after this fades the Maxwell spot is seen again through the purple filter but more vividly. The central spot in the entoptic pattern coincides with the rod-free area and the blue-blind foveal field of Koenig, Willmer, and Wright. Protanopes and protanomals see the Maxwell spot as blue; deuteranopes, deuteranomals, and achromates see no Maxwell spot. These facts add overwhelming evidence to the view that protanopia and deuteranopia are basically different.

The various normal and abnormal configurations of the Maxwell spot are detailed with their possible genetic implications. The Maxwell pattern portrays the relative number of redness and blueness receptors in the different zones. The greenness distribution is probably seen in the sequential image through the neutral filter. Normally the ratio of greenness to redness receptors is lowest at the foveal center and increases progressively to the 4.0-degree zone. The protanope with redness receptors lacking has blueness receptors (light-adapted rods) in their place. As a consequence the visual acuity of protanopes is depressed in red light and relatively enhanced in blue light. Analysis of color-normal carriers of protanopia suggests the segregation of brightness and huedness connotations and their separate vulnerability.

James E. Lebensohn.

REFRACTION AND MOTILITY. By Walter B. Lancaster. Springfield, Illinois, Charles C Thomas, 1952. Price: $7.75.

Dr. Lancaster's fine book, which appeared after his death, vividly recreates the breath and spirit of his strong personality. When reading it, you have the impression that you are listening to him talk.

By diagrams and explanations, his book reduces to a simple problem the complex study of light, waves, shadows, reflections, lenses, mirrors, refraction of light by curved surfaces, cylindrical lenses, and the prismatic effects of lenses.

The subjective method of refraction as used by Dr. Lancaster is given in detail and the value of the study of ocular motility (his major contribution to ophthalmology) is emphasized as an essential part of the subjective technique. He emphasizes the difference in the use of glasses for vision and for eyestrain.

In the appendix, there are 50 questions on physiologic optics and refraction. The answers are given in a most refreshing way. The questions will be of great help to those preparing for the Board examination.

It is an excellent book to supplement previous study and work in refraction and gives the new, as well as the old, refractionist something to think about.

Beulah Cushman.

GÖZ KLINIGI. Edited by Dr. Nuri Fehmi Ayberk. Istanbul, Turkey, 1952, vol. 10, no. 1 and 2.

This Turkish journal of clinical ophthalmology inaugurates its 10th year with a special issue containing many foreign contributions in English, French, and German; besides many interesting case reports by Turkish ophthalmologists, which include optochiasmatic arachnoiditis, suprasellar meningioma, corneal transplantation, and interstitial keratitis treated with cortisone.

Charamis of Athens favors the original Barraquer erisophake in intracapsular extractions; Guillaumat of Paris discusses the surgery of congenital cataract and suggests that parents be warned of the generally poor visual prognosis.

In the more desperate cases of retinal separation, Lindner of Vienna follows diathermy with globe shortening at the same intervention. Nataf of Tunis classifies the agents producing inclusion bodies as "Prowazekias" and suggests naming that of trachoma, Prowazekia trachomatis.

Scott of Edinburgh discusses perimetry in glaucoma, emphasizing the significant progressive changes revealed by the tangent screen with small targets while the peripheral field may remain intact. Streiff and Moginier of Lausanne, in a survey of the value of nicotinic acid in ophthalmology, laud its use especially for optic and retrobulbar neuritis which they treat by daily retrobulbar injections of 50 mg. sodium nicotinate.

James E. Lebensohn.

BETWEEN TWO WORLDS. By Benjamin L. Gordon, M.D., New York, Record Press, Inc., 1952, 346 pages. Price. $4.00.

This story of Americana could not have been written anywhere else except in our beloved country. It presents a vivid picture of the Jewish community of Eastern Europe that was to shape the early life of the author. It tells of his life as an astute and learned Hebrew scholar, and of his escape from military service under the Czar. He relates fully his formal education in America as an immigrant youngster. His emergence as a physician and ophthalmologist before the turn of the century is particularly well documented, and will be more than familiar to many of his compatriots.

The influence of a Zionist and Hebrew education on the author's life shows again that education, regardless of its native tongue, is an asset to any student. Dr. Gordon has written many fine treatises on Zionism. *Between Two Worlds,* with its rare combination of pathos and humor, capably presented, recommends itself.

Nathan K. Lazar.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Rusodimos, C. N. **Therapy of exudative circumscribed choroiditis with non-perforating diathermy coagulation.** Arch. Soc. oftal. hispano-am. **12**:522-534, May, 1952.

The literature on circumscribed exudative choroiditis is reviewed, and 408 cases analyzed as to geographic distribution, location of the lesion, the eye involved, and sex and age of the patient. The author found milk injection the most valuable therapeutic agent. Resistant cases were treated with nonperforating diathermy coagulation over the inflamed focus, with a current of 40 milliamperes for four seconds. Five cases are reported in detail to demonstrate the effectiveness of this procedure. Cicatrization was complete in four weeks in three cases, and in six weeks in two. Ray K. Daily.

9

GLAUCOMA AND OCULAR TENSION

Chandler, P. A. **Narrow-angle glaucoma.** A.M.A. Arch. Ophth. **47**:695-716, June, 1952.

The classifications of glaucoma are reviewed and discussed. The different clinical characteristics of the narrow-angle type and the wide angle type of primary glaucoma, and responses to therapy are discussed. The work of Morton Grant in particular indicates that increase in tension is due to impairment of aqueous drainage from the eye rather than increased aqueous formation. The etiology, diagnosis, clinical course, and treatment of narrow angle glaucoma are discussed under separate headings. The principal factor in producing a shallow chamber and narrow angle is the size of the lens in relation to the anterior segment of the globe. Factors important in producing a rise in tension in an eye with a narrow angle are dilatation of the pupil, sudden engorgement of the uveal tract and relative pupillary block. In this last instance aqueous cannot gain access to the anterior chamber because of contact between the anterior surface of the lens and the posterior surface of the iris.

The author subdivides narrow angle glaucoma into acute and subacute or chronic narrow angle glaucoma. Acute narrow angle glaucoma is intermittent and not accompanied by changes in the disc unless the attack has been unrelieved for two

weeks or more. Chronic narrow angle glaucoma may simulate the wide angle type but is more rapid in its course. It is accompanied by cupping of the disc. In both acute and chronic narrow angle glaucoma there are prodromal and periodic elevations of tension with spontaneous recovery. In the chronic type the attacks are more frequent, peripheral anterior synechiae form more rapidly and permanent closure of the angle with resultant blindness occurs sooner.

The use of miotics is the medical treatment of choice for acute glaucoma. If after two or three hours miotics fail to lower the tension operation is advised. Peripheral iridectomy or iridotomy is preferred if the angle is not blocked by synechiae. These procedures are recommended when the first attack of glaucoma is of less than 36 hours duration or when the tension can be reduced with miotics or spontaneously. The author prefers an ab externo limbal incision with peripheral iridectomy and tight suture. In late cases a filtering operation or a modified iridectomy and freeing of the angle with a cyclodialysis spatula is necessary. This procedure is described. In chronic narrow angle glaucoma a miotic should be given in sufficient strength and frequency to keep the tension normal always. If this is not possible peripheral iridectomy or iridotomy may suffice, but more often a filtering operation is necessary. The author prefers a combined cyclodialysis and peripheral iridectomy.

George S. Tyner.

Keeney, A. H., and Leopold, I. H. **Evaluation of capillary mechanisms in primary glaucoma.** A.M.A. Arch. Ophth. **47**: 720-727, June, 1952.

Standard capillary studies including the Göthlin index, capillary morphology of the nail beds, cutaneous lymph flow, and the capillary response to histamine were studied in patients with primary glaucoma and in controls. There was no increase in capillary fragility or of the capillaries in the finger nails of glaucoma patients. Data on cutaneous lymph flow suggested that patients with chronic glaucoma frequently have a capillary fault which permits increased filtration. Injections of intradermal histamine produced less capillary dilatation in glaucoma patients than in controls. These studies suggest that capillary faults may be a causative factor in some cases of primary glaucoma.

George S. Tyner.

Morpurgo, F. **The effect of dicumarol on the visual fields in glaucoma.** Ann. di ottal. e clin. ocul. **78**:109-120, Feb., 1952.

Dicumarol, in daily doses averaging 100 mg. after an initial dose of 200 to 300 mg. was administered for 10 to 15 days to 20 patients with chronic simple glaucoma. Case reports are given of the 11 who showed regression of field loss. Improvement was usually first noted toward the end of the period of administration, subsequently become more marked, and in some cases persisted several months. The greatest improvement was noted in mild and early cases. The results are superior to those obtained with other drugs and confirm the theory that field loss in glaucoma is due not to the mechanical effect of pressure but to vascular changes in the optic nerve. No effect of dicumarol on ocular tension was noted. (References)

Harry K. Messenger.

Rama, G. **Can "Roter" have provoked an attack of glaucoma in a predisposed subject?** Ann. di ottal. e clin. ocul. **78**: 274-278, April, 1952.

Roter is an empirical mixture of which only one ingredient, the aromatic bitter calamus rhizome, can be considered as even remotely likely to induce an attack of glaucoma. Certain aromatic bitters enhance the action of adrenalin by sensitizing the adrenergic receptors. The patient in question, whose affected eye had under-

gone a perforating keratoplasty and a cataract extraction with iridectomy a year or so before, experienced an attack of glaucoma shortly after taking Roter for relief of gastric distress. The attack was successfully controlled by a simple cyclodialysis. It is conjectured that the calamus may have precipitated the attack by sensitizing the adrenergic receptors to the action of adrenalin liberated by psychic shock. (References)

Harry K. Messenger.

Sippl, F. **Applications of the cold pressor test.** Klin. Monatsbl. f. Augenh. **118**: 156-165, 1951.

This test, which was devised to detect labilities of the vascular system, gave completely normal results in 48 cases of primary glaucoma.

Frederick C. Blodi.

Vannini, A. **Gonioscopy in primary glaucoma.** Rassegna ital. d'ottal. **21**:65-95, March-April, 1952.

The author gives an excellent review of the present state of knowledge gained by the use of the gonioscope and illustrates it with numerous beautifully colored plates. From the study of 19 cases of congestive glaucoma he concludes as follows: 1. the angle is pervious, even if narrow, at the beginning of the hypertensive crisis, and its appearance is approximately normal, 2. the closure of the iris angle by the iris root, which adheres to the corneoscleral wall, occurs early in the attack, 3. the angle is blocked during the attack, 4. the angle tends to open as the crisis recedes, 5. the angle opens again in part after the crisis. If the hypertension was of short duration the angle may assume a normal appearance, otherwise goniosynechiae appear. Repetition of attacks causes more and more anterior synechiae. The gonioscopic appearance of postoperative cases is presented. (19 figures, 84 references)

Eugene M. Blake.

10

CRYSTALLINE LENS

Aguillar Munoz, Jose. **Refinements in cataract extraction.** Arch. Soc. oftal. hispano-am. **12**:604-613, June, 1952.

For retraction of the lids, Aguillar designed a contrivance which consists of the spoon of a lid elevator, perforated for the attachment of a thread. The thread is clamped to the head towel with a hemostat. He also designed a forceps shaped somewhat like a Hess iris forceps for grasping the superior rectus. The author stresses the importance of perfect immobilization of the lids and the globe, full and lasting mydriasis, paresis and fixation of the superior rectus, and a keratotomy exactly in the limbus. (5 figures)

Ray K. Daily.

Caballero Castillo, Daniel. **Corneo-sclero-conjunctival suture in cataract extraction.** Arch. Soc. oftal. hispano-am. **12**: 280-286, March, 1952.

Castillo uses two double armed sutures, with an intermediate knot in each. After making the conjunctival flap, one needle is passed through the cornea radially at 11:30 o'clock. It is then passed in the same direction through the sclera. The other end of the suture is passed in the same manner at 10 o'clock. Similar sutures are passed at 12:30 and 2 o'clock. There are thus two U-shaped sutures with an intermediate knot. After the extraction is completed, the two central threads are drawn together to close the wound. They are then passed through the conjunctiva, which is drawn down over the incision, and tied together. The lateral ends of the sutures are drawn through the lateral edges of the conjunctiva and are tied so that the conjunctiva is drawn down over the lateral portions of the incision. (7 figures)

Ray K. Daily.

D'Andrade, L. **Intracapsular cataract extraction (total phacectomy).** Arq. portug. de oftal. **3**:19-61, 1952.

Extraction of the crystalline lens within its capsule was apparently attempted for the first time in 1757. Even today it has not been universally accepted as the procedure of choice in the treatment of cataract. The author summarizes his experiences with over 2,000 patients in a period of eight years. He distinguishes four types of senile cataract, and each has its own method of extraction. Type 1 is diffuse gray in color and is homogeneous. It is the most common cataract seen, and is best extracted by forceps. Type 2, which is intumescent and resembles mother-of-pearl in color, has a capsule which ruptures easily. Therefore, forceps may not grasp the capsule well, and the extraction in capsule may be successful by use of the erisophake or zonulotome. The cataract type 3 is homogeneously milky in appearance, and is an early stage of hypermaturity. The capsule is very friable, and the zonule weak. Here the zonulotome is indicated. Cataract type 4 is sclerosed and is brown or black in color. In this instance, the author feels that subtotal, or extracapsular extraction is warranted. A normal lens in one eye does not contraindicate surgery for unilateral cataract. The use of a speculum is inadvisable in cataract surgery, safer exposure of the operative field being afforded by the placing of sutures in each lid, and under the tendons of the superior, medial, and inferior rectus muscles. The latter sutures eliminate the need for fixation forceps and allow better control of the globe. The author prefers to make the corneal section entirely with a Graefe knife, in the belief that the incision is more regular, and fewer accidents occur. A variety of sutures is illustrated, the author's preference being three conjunctival sutures. A single peripheral iridectomy precedes the actual extraction of the lens. If the lens is to be delivered by forceps, it is grasped below and delivered by tumbling. Traction is combined with light external pressure, made, preferably, by a curved propulser designed for that particular purpose. A gentle zig-zag motion with the forceps while grasping the lens facilitates rupture of the zonule and delivery of the lens. The zonulotome is used when the lens is hypermature. The instrument is passed into the anterior chamber, parallel to the anterior face of the lens, to the inferior aspect, and is maneuvered around the semi-circumference of the zonule, rupturing the fibers. It is withdrawn when the lens is luxated. The lens is then delivered by external pressure from below and above the corneal section. In those few instances when vitreous appears in the chamber, delivery is completed by loop extraction. The lens may also be extracted within its capsule by means of the Smith procedure or the use of the erisophake, neither of which has found favor with the author. Electro-coagulation of the lens is described but not recommended.

When the extraction is completed, the sutures are tied and the iris is carefully replaced. The lids are kept closed by means of the sutures used for exposure of the globe during surgery. Complications arising during and after are briefly mentioned. One colored plate illustrates the various types of cataract discussed in the text, and drawings show sutures, instruments, and surgical techniques.

James W. Brennan.

Kirman, B. H. **Familial cataract and mental deficiency.** Lancet **1**:694-696, April 5, 1952.

A case of congenital familial bilateral cataract with imbecility is described. The potential causes of cataract at any age are many and are both genetic and environmental. The author states that with a proper concentration of study of this prob-

lem, the nature and mode of action of the noxious factors may be understood.

Thomas A. Burns.

Pritikin, R. I., and Duchon, M. L. **What to tell a patient with early senile cataract.** Am. Pract. **3**:384, May, 1952.

No other condition of the eyes is said to be exploited by as many illegitimate cures as senile cataract. The patient must know that claims for drugs which are said to dissolve the cataract are fraudulent. Metabolic studies, search for infections and investigations, of glandular balance should be made and the defects corrected. The progress of the opacity may thereby be inhibited. Biennial checkups, including refraction and discussion which may maintain morale and prevent mental depression are an essential part of the treatment. There is no need for hastening maturing or ripening; the patient is ready for surgery when daily tasks cannot be performed. Francis M. Crage.

de Ocampo, Geminiano. **Cataract extraction in diabetes mellitus.** Acta Med. Philippina **8**:113-120, Oct.-Dec., 1951.

The author reviews his experience with 36 cases of senile cataract in elderly diabetics and concludes that with extra care in the pre-operative and post-operative management the over-all visual results of cataract extraction in senile diabetics can compare favorably with that in normal subjects. The author emphasizes that a blood sugar level of 150 to 160 mg. is optimal, provided the test for acetone in the urine is negative and the blood prothrombin time is not prolonged.

Mitchell B. Rider.

11

RETINA AND VITREOUS

Aguilar Bartolome, J. M. **Biomicroscopy of the vitreous in myopia treated with histiotherapy.** Arch. Soc. oftal. hispano-am. **12**:627-640, June, 1952.

It is generally believed that improvement of visual acuity in myopes is the result of a clearing of the vitreous, the transparency of which was diminished by hemorrhages or exudates. The object of this investigation was to determine the response of the vitreous to histiotherapy. Only the anterior portion of the vitreous, which is accessible to the ordinary examination with the slitlamp was studied. The material comprises 129 myopes treated with implantations of placenta and injections of placental extract. The patients were divided into three groups. The first group consisted of 14 patients under 40 years of age, without fundus changes, the second of 81 patients under 40, with myopic fundus changes. The 34 patients in the third group had myopia complicated by senile changes, retinal detachment, and uveal lesions. This study shows that traumatic changes in the vitreous remain irreversible under histiotherapy. The foreign elements in the vitreous such as pigment cells, leucocytes and blood cells clear up in about one third of the cases. The opacities resulting from destruction of the vitreous disappear to a much lesser degree. Histiotherapy has no effect on senile changes. In retinal detachment the vitreous clears significantly although the destruction of its architecture persists. In uveal affections histiotherapy is of no value, and in some cases it has an unfavorable effect, especially so in the acute disease. The number of traumatic hemorrhages was too small to justify a definite opinion on the effect of histiotherapy. The vitreous in myopic eyes with luetic transverse optic neuritis appears to clear up under histiotherapy independently of antiluetic treatment. Ray K. Daily.

Bartolozzi, R. **Familial macular heredodegeneration.** Arch. Soc. oftal. hispano-am. **12**:163-177, Feb., 1952.

Stargardt's macular degeneration in four out of five siblings is reported. The patients, 17, 16 and 11 years old, had well defined macular lesions and central field changes. A girl, 12 years old, had normal fundi, but relative central scotomas could be demonstrated on a Bjerrum screen. The youngest child, 7 years old, had no fundus changes, and was too young for accurate field studies. One patient had, in addition to the typical macular lesion, changes in the peripapillary and temporal regions of the left eye. The peripheral lesion was progressive; it was found to be enlarged one year later. The patient had poor nocturnal vision, and impaired dark adaptation which is not typical of this disease. The literature on this lesion is reviewed. (15 figures) Ray K. Daily.

Belmonte Gonzalez, Jose. **The fundus of the myopic eye in retinopathies of vascular origin.** Arch. Soc. oftal. hispano-am. 12:622-626, June, 1952.

It is pointed out that retinopathies of vascular origin are very rare in myopes. The author briefly describes three patients with very high blood-pressure, without any signs of hypertension in the fundus. Hemorrhages and exudates in the fundus, of vascular origin, are caused by a change in capillary permeability in which various factors are involved, such as the blood pressure, the composition of the blood, and the ocular tension. The low ocular tension associated with myopia facilitates passage of the blood. For this reason changes in the vascular walls caused by an impeded circulation are less apt to develop in a myopic eye than in a normal one. This characteristic of myopic eyes should be kept in mind when examining a fundus for the determination of the vascular state. In myopia negative fundus findings do not exclude the presence of a grave vascular process or kidney disease.

Ray K. Daily.

Bonavolontà, G. **Importance of chorioretinitis and retinal tears in idiopathic retinal detachment.** Boll. d'ocul. 31:206-220, April, 1952.

Of 300 eyes with retinal detachment, 197 (more than 65 percent) showed chorioretinal disease. Eighty-six (28 percent) were located in the equatorial region, 42 (14 percent) were of the disseminated type, 6 (2 percent) showed one single focus and 63 (21 percent) were a mixed type chorioretinitis. In 65 eyes (21 percent) the retinal tear corresponded to the chorioretinitic lesion. Tears with a flap were more frequent (44) than holes without a lid (21). Of all discontinuities, 51 were peripheral, 11 central and 3 in the macula. The importance of small peripheral tears related to chorioretinitis is stressed; they may well be secondary to the detachment. The data are tabulated and six illustrative cases are reported. (References) K. W. Ascher.

Cascio, G. **Circulatory and metabolic aspects of patients with thrombosis of the central retinal vein.** Ann. d'ocul. 185:640-651, July, 1952.

The author statistically analyzes 13 cases of retinal venous thrombosis in patients with degenerative vascular diseases, such as hypertension, diabetes, and atherosclerosis. In each case the coagulation time of Quick, the blood sedimentation rate, and the blood heparin, cholesterin, and protein content was determined. In more than half of the cases the blood prothrombin and cholesterol content was increased and the heparin blood content was decreased. In two-thirds of the cases a constitutional predisposition apparently existed. This study suggests that patients with metabolic and circulatory diseases who have retinal venous thrombosis usually have an enzymal constitutional predisposition as well, which involves blood coagulation and tension and the permeability of the venous capillaries and

smallest venules. In time adverse environmental factors cause red blood cells to exude through the capillary and venous postcapillary walls. Chas. A. Bahn.

Castroviejo, R. M., and Torres-Lucena, M. **Scleral resection in the treatment of retinal detachment.** Arch. Soc. oftal. hispano-am. **12**:152-161, Feb., 1952.

Sixteen cases of detachment in the temporal portion of the retina including the macula are reported. Scleral resection is indicated in aphacics in whom a retinal hole can not be found, or in whom other procedures failed, in cases in which the retina does not become reapplied after rest, because it is fixed by traction bands, in detachments with turbid media and vitreous detachment in high myopes, in scleral staphylomas, and, as a last resort, to preserve whatever visual field is left. The authors add diathermy coagulation or superficial diathermy to the scleral resection. In half of the authors' 16 cases the retina became reapplied with restoration of the visual field and improvement in visual acuity, which in one case rose to 20/80. Ray K. Daily.

Cholst, M. R., Levitt, L. M., and Handelsman, M. B. **Small vessel dysfunction in patients with diabetes mellitus: retinal vessel response in diabetics following Priscoline.** Am. J. M. Sc. **224**:39-41, July, 1952.

By means of angioscotometry the authors studied the vasodilatory effect of intravenous Priscoline (50 mg.) on the retinal vessels of 28 diabetics who had little or no retinal vascular sclerosis. Twelve of the 28 patients showed poor vasodilatory response; in eleven of the 12, perimacular hard exudates were present. Poor retinal vessel response could not be correlated with other findings of diabetic retinopathy or with poor peripheral vascular dilatation as measured by skin temperature changes in the toes following the intravenous injection of Priscoline.

Mitchell B. Rider.

Corrado, Mario. **Behavior of the hyaloid membrane as observed at various intervals after intracapsular cataract extraction.** Ann. di ottal. e clin. ocul. **78**:375-392, May, 1952.

Corrado studied the hyaloid membrane at intervals postoperatively in 15 cases of intracapsular cataract extraction. The membrane, with or without the anterior part of the vitreous, often herniates into the anterior chamber but tends later to retract to a position behind the iris. As it retracts its normal grayish color may deepen, but without effect on vision. Inflammation of the uvea may cause thickening. Rupture may occur at the time of operation or later but is without clinical importance. In one case of rupture a noninflammatory pseudomembrane simulating the real hyaloid membrane was found to have developed on the surface of the exposed vitreous. (16 figures, references)

Harry K. Messenger.

De Crecchio, A., and Del Bello, N. **Effects of sinusal neurectomy in experimental retinitis pigmentosa.** Ann. di ottal. e clin. ocul. **78**:323-326, May, 1952.

Pigmentary degeneration of the retina was induced in rabbits by injecting sodium iodate. Subsequent extirpation of the carotid body and denervation of the carotid sinus resulted in improvement which was demonstrable objectively, ophthalmoscopically, and histologically. The author suggests that similar treatment could be beneficial in human retinitis pigmentosa.

Harry K. Messenger.

Dolcet, Luis. **Retrolental fibroplasia.** Arch. Soc. oftal. hispano-am. **12**:395-401, April, 1952.

Dolcet attributes retrolental fibroplasia to the persistence of a high ocular tension,

which is physiological in the newborn, a disturbance in the anatomic structure of the venous circulation of the eye, and a physiotoxic process, due to the faulty elimination of physiologic products of metabolism. Ray K. Daily.

Duc, C., and Busti, A. **A contribution to the study of retinal tumors.** Rassegna ital. d'ottal. **21**:163-171, May-June, 1952.

The author describes three cases of retinal glioma and calls attention to the frequent polymorphism of the histologic picture and the consequent difficulty in placing a particular case in one of the classifications proposed by various pathologists. The authors consider it very desirable to follow enucleation by X-ray treatment. Mawas announced that the presence of rosettes was an indication of the stage of development of the particular cells. He suggests three stages, 1. the retinoblastoma, composed of embryonic cells, 2. retinocytes, with a differentiation of cells visibly young and with rosettes, and 3. retinomas, a complex and multiple group arising from nerves, pigment and glands.
Eugene M. Blake.

Findlay, G. H. **On the pathogenesis of incontinentia pigmenti: with observations on an associated eye disturbance resembling retrolental fibroplasia.** Brit. J. Derm. **64**:141-146, April, 1952.

Incontinentia pigmenti is a primary skin condition appearing at birth or soon afterwards. It is suggested that it is the end result of a transitory guttate and band-like scleroderma of the newborn. Of the 25 reported cases, eight have shown eye abnormalities. Six of these revealed retinal detachments and the diagnosis, according to Uebel, was consistent with either retrolental fibroplasia or congenital retinal fold. The eye lesions were hard to classify and probably represented an intermediate variant of the two conditions. A case report of incontinentia pigmenti with eye manifestations is presented.
Thomas A. Burns.

Hipsley, E. H. **Incidence of retrolental fibroplasia in premature infants.** M. J. Australia **1**:473-475, April 5, 1952.

The author tabulates the results of his survey of 97 premature infants weighing three pounds or less at birth. The study showed that five developed retrolental fibroplasia. In a group of six infants weighing less than two pounds, three showed the condition, indicating that retrolental fibroplasia is a major hazard of this birth-weight group.
Francis M. Crage.

Huerkamp, B. **Measurement of rapid changes in the diameters of retinal blood vessels.** Arch. f. Ophth. **152**:485-490, 1952.

The author uses indirect ophthalmoscopy. He places a set of thin wires in the focal plane of the +13.0D. lens used in studying the inverted image. Comparison of the retinal vessels with these wires permits rapid estimation of changes of their widths. Ernst Schmerl.

Huerkamp, B. **The retinal blood vessels in acute and chronic changes of the blood.** Arch. f. Ophth. **152**:491-513, 1952.

The author used the procedure described in the preceding abstract and found changes in the diameter of the retinal vessels when men or animals were exposed to hyperventilation or stimulation of the sympathetic. Lack of oxygen over longer periods, as in exposure to high altitude, caused an increase in number and length of the retinal blood vessels of rabbits. Experimental anemia temporarily decreased the length and number of the blood vessels. Ernst Schmerl.

O'Reilly, G. **Retinoblastomas.** Arch. chil. de oftal. **22-23**:103-106, 1949.

Retinoblastoma is found in approxi-

mately one patient out of 10,000 examined, and it may be bilateral in as many as 30 percent. The tumor in the second eye is an independent focus, although it may not be manifest for months or even years after the first lesion is discovered. In 75 percent of cases, it occurs before the age of three years. In the differential diagnosis, one must consider congenital anomalies such as retrolental fibroplasia, retinal detachment, angiomatosis, pseudoglioma, uveitis, and massive hemorrhage of the choroid. Radiographic demonstration of calcium aids the diagnosis. In case of doubt, if the eye is blind, enucleation is recommended.

Treatment for unilateral retinoblastoma is enucleation, with excision of a large portion of the optic nerve, as this is the main avenue of metastasis. However, both eyes should be examined before surgery, under anesthesia or deep sedation, and with maximum mydriasis. Should both eyes be involved, bilateral enucleation is occasionally recommended as a life-saving procedure. More often the eye with greater involvement is removed and the remaining eye is treated by radiation, following the technique of Martin and Reese. Over a period of 15 years 22 percent of patients treated have died of retinoblastoma, and 30 percent are alive, retaining useful vision. Complications of radiation therapy are retinal hemorrhage, cataract, secondary glaucoma, retinitis proliferans, and atrophy of the globe.

James W. Brennan.

Pau, Hans. **The physiology and pathology of the vitreous body.** Arch. f. Ophth. **152**:201-247, 1951.

Slitlamp and microscope were used to study the vitreous body of man, cow and pig in vivo and in vitro. The vitreous seems to be formed by layers of folded membranes. The membranes travel from the pars plana of the ciliary body to the peripapillary zone of the optic nerve and loosely surround Cloquet's canal in onion-shell arrangement. The possibility is considered that the membranes derive from the tissue formed between the vessels of the embryonic vitreous body. Changes of the structure of the vitreous body due to inflammations or degeneration can experimentally be repeated when the vitreous is kept in Ringer's or other solutions. Shrinking seems to be an irreversible process. Cystoid degeneration of the retina might be related to contractures of the vitreous tissue.

Ernst Schmerl.

Rama, G. **Etiology and treatment of retinitis pigmentosa with special consideration of the use of melanophore hormones.** Rassegna ital. d'ottal. **21**:143-162, May-June, 1952.

A series of cases of pigmentary degeneration of the retina was divided into four groups, according to the history and development. In the first group are the cases with a clear family history of the disease, while in the second group a family history existed but the disease arose only after a morbid process in the body. In the third group, no family history was present, but the process arose after sickness, while the fourth group comprised those cases with no preceding family history. In 64 percent of the cases a familial hereditary factor was noted, in 15 percent consanguinity was reported. The eyes were myopic in 50 percent, hyperopic in 12 percent, the remainder emmetropic. Hyperacusia occurred in 45 percent of cases and glaucoma developed in one patient. The author concludes that factors other than heredity may cause the picture of retinitis pigmentosa.

Twenty-seven patients were treated with a melanophore hormone, employed by injection, instillation, or the two combined. In general the effect on vision was good, less so on the field of vision and nil on the light sense. There appears to be no evidence that this or any other treatment

has much advantage in the attempt to improve the nutrition of the visual elements.

Eugene M. Blake.

Stergar, S., and Esche-Duval, L. **Dystrophia adiposo genitalis, punctuate retinitis albescens, pigmentary retinitis and cataract of endocrine origin (hypophyseal).** Ann. d'ocul. **185**:543-548, June, 1952.

A 20-year-old man with dystrophia adiposo genitalis, dry skin, deformed nails, dilated superficial vessels and mental deficiency had the following eye findings: rotary nystagmus, hypermetropic astygmatism, posterior polar cataract and vitreous opacities. Ocular tension was very low, especially in the left eye. The eyeground was yellowish red, the disc pale, pigmented on the nasal side, the vessels narrow, almost invisible at the periphery. The entire eyeground showed bonecorpuscle-like pigment masses. The left eye was amaurotic, the right had light perception. The patient had been examined ten years previously and a punctate retinitis albescens had been found. A few scattered pigment areas were seen peripherally at this time. Vision could be corrected to 5/10. The visual field was concentrically constricted. Within the following year vision began to deteriorate, the pigment in the eyeground increased and the vessels became narrowed.

The authors point out as of special interest: 1. the bilateral star shaped posterior polar cataract, 2. the changes in the eyeground, first a slight narrowing of the retinal vessels, then a punctate retinitis albescens which progressed within a period of eight years into true pigmentary retinopathy. This development proves anew that these two diseases belong to the same group and can be seen successively in the same patient. The grouping of the pigment masses around the macula and the posterior pole were striking characteristics of the case described. No form of treatment was of any avail. (1 figure, 4 references) B. T. Haessler.

Vetter, J. **The neurocirculatory dystony of the retinal vessels.** Klin. Monatsbl. f. Augenh. **118**:165-171, 1951.

This term, coined by Hochrein, is suggested for all functional vascular disorders of the retina. The incidence of this entity has increased in the last decade. The author also describes a case of acute intoxication with sodium nitrite. Defects in the visual field were observed by the patient. Frederick C. Blodi.

12

OPTIC NERVE AND CHIASM

Mariotti, Lorenzo. **Partial evulsion of the optic nerve by indirect trauma.** Ann. di ottal. e clin. ocul. **78**:335-340, May, 1952.

Mariotti describes a case of partial evulsion of the optic nerve of the right eye of a youth thrown to the ground in a collision. From the ophthalmoscopic appearance it is concluded that the dural sheath of the optic nerve was not torn from its attachment to the globe, but the nerve fibers of the temporal half of the papilla were severed. (2 figures, references)

Harry K. Messenger.

13

NEURO-OPHTHALMOLOGY

Band, Raymond I. **Optic atrophy caused by an arteriovenous angioma.** Arch. Neurol. & Psychiat. **67**:655-660, May, 1952.

A man, aged 21 years, had blindness with atrophy in the left eye, normal vision and pallor of the nerve in the right eye. Laboratory tests were negative. A frontotemporal operation revealed an arteriovenous aneurysm in the supraclinoid region at the optic chiasm. Two somewhat similar cases were found in the literature but neither of them showed optic nerve atrophy and blindness as the only presenting signs. Francis M. Crage.

Böke, W. **The significance of ocular symptoms in intracranial tumors.** Klin. Monatsbl. f. Augenh. **118**:113-133, 1951.

The author analyzes the ocular symptoms of 115 patients with intracranial tumors. Papilledema occurred in 61 percent of the cases. It occurred most frequently with tumors in the posterior cerebral fossa, but it was common enough with tumors in other regions to be of no topographic diagnostic value. Pupillary symptoms were comparatively rare and anisocoria occurred only in 20 percent of the patients. Disturbances of ocular motility were also observed in about 20 percent of the cases. Frederick C. Blodi.

Dejean, C. **The syndrome of hemorrhage of the cavernous sinus.** Arq. portug. de oftal. **3**:9-18, 1951.

Because of the complex anatomic relationships of the cavernous sinus, disease processes about the sinus produce a variety of ocular signs and symptoms. Compression of the sinus either by thromophlebitis or by aneurysm or rupture of the internal carotid artery brings about palsies of the extraocular muscles followed by anesthesia of the trigeminal nerve. Neuralgia of the nerve also occurs. Total compression presents the well known picture of ophthalmoplegia, exophthalmos, chemosis of the conjunctiva, lid edema, vascular congestion of the retina, and possibly papilledema and blindness. In the differential diagnosis several tumors must be considered. The prognosis is grave.

In rare instances the hemorrhagic syndrome is found, and a case history is presented to illustrate the sequence of events. There is almost always a history of trauma, a gun shot wound in the case presented. Fractures of the orbit and base of the skull are possible sources of such disastrous hemorrhage. Considerable bleeding results, and may be external from the nose and sphenoid sinus, or intracranial. The hemorrhage stops spontaneously if the lesion is small and did not arise in the internal carotid. Compression of neighboring structures by the hematoma may produce ophthalmoplegia, anesthesia, and blindness or may extend to the cerebral peduncle. James W. Brennan.

de la Fuente, Leoz G. **Hemorrhage in the left cerebral ventricle with contralateral hemianopsia, and a fatal recurrence.** Arch. Soc. oftal. hispano-am. **12**: 178-183, Feb., 1952.

The patient, a girl 19 years old, was taken ill suddenly. After recovery from coma and the motor symptoms caused by compression of the pyramidal tract, she was found to have a right homonymous hemianopsia sparing the macula, and paresis of the sixth and seventh right cranial nerves. The diagnosis was a hemorrhage in the choroidal plexus of the left ventricle with perforation of its wall in the optic radiation. For three years the patient was apparently well. Three years later she had another attack similar to the first with severe headache, vomiting, and coma and died eight hours later. An autopsy revealed the first hemorrhagic focus close to the external wall of the left lateral ventricle, and a fresh hemorrhage which occupied the inferior parietal convolution, invaded the cortex and subdural space and spread along the convexity of the brain. The histologic examination showed that the source of the hemorrhage was an arterial aneurysm in the choroidal plexus, and multiple microaneurysms along the entire course of this artery. (4 figures) Ray K. Daily.

de la Fuente, Leoz G., and Bartolozzi Sanchez, R. **A pupillary sign for the differential diagnosis of paralysis of convergence.** Arch. Soc. oftal. hispano-am. **12**:287-299, March, 1952.

The innervation of accommodation and convergence is reviewed and an examina-

tion of the pupillary contraction is advocated for the differential diagnosis of innervational paralysis of convergence of central origin, and paralysis of convergence due to peripheral lesions. In making the test, accommodation is eliminated by the use of convex glasses, so that the contraction of the pupil remains as a response of convergence alone. In paralysis due to a peripheral lesion, the pupils contract if an effort to converge is made because the central pathways are intact; in paralysis of convergence of central origin there is no pupillary contraction. (5 figures)

Ray K. Daily.

Harms, H. **The hemianopic pupillary reaction.** Klin. Monatsbl. f. Augenh. **118**: 133-147, 1951.

Thirteen patients with lesions in the optic pathway were examined with the author's exact method as to their pupillary reactions and visual fields. He found that any lesion of the field was connected with a disturbance of pupillomotor excitability. The presence of a pupillary hemianopic reaction is therefore of no topographic diagnostic value. It was even present in pure cortical lesions.

Frederick C. Blodi.

Marquez, M. **Oculomotor associations of near vision.** Ann. de Soc. mex. de oftal. **25**:207-214, Oct.-Dec., 1951.

The author presents a case of a traumatic rupture of the internal carotid artery in the cavernous sinus showing symptoms of unilateral Argyll Robertson pupil as well as a pulsating exophthalmus, thrill and orbital venous engorgement. Three months later an atypical Argyll Robertson pupil was observed in the right eye, consisting of a lack of direct pupillary light reflex, presence of a near reflex and a mild mydriasis. He discusses in great detail stimuli which control the size and reaction of the pupils and the pathways through which these stimuli are transmitted.

Jose F. Pietri.

Millan, M. **Aneurysm of the circle of Willis.** Arch. chil. de oftal. **22-23**:129-130, 1949.

Recurrent frontal headaches in a 59-year-old patient, followed by paralysis of the third and fourth cranial nerves led to a tentative diagnosis of a lesion in the middle cranial fossa. The nature of the headaches, combined with a disturbed sensitivity of the ophthalmic division of the trigeminal nerve, made the diagnosis of aneurysm seem likely. Visual acuity was not disturbed. Before X-ray films could be taken, the patient suddenly lost consciousness as a result of subarachnoid bleeding and soon died. Autopsy confirmed the diagnosis of rupture of a large aneurysm of the internal carotid artery at its junction with the posterior communicating artery.

James W. Brennan.

Parkinson, D., Rucker, C. W., and Craig, W. McK. **Visual hallucinations associated with tumors of the occipital lobe.** Arch. Neurol. & Psychiat. **68**:66-68, July, 1952.

The authors give a short historical background on visual hallucinations occurring with lesions of the occipital lobe. Fifty cases of tumor limited to the occipital lobe were studied; in 12 hallucinations were a symptom. The question of site or origin of hallucinations in general, and of formed hallucinations in particular could not be answered. There was no preponderance of any one location, or of any type of tumor in the patients having hallucinations. There was no instance in which the hallucination could be proved to be projected outside the confines of a field defect when a field defect was present. The concept, that from lesions limited strictly to the occipital lobe, hallucinations, when present are usually of the unformed variety and are limited to

the opposite field, usually to the area of a field defect, is compatible. A case is cited in which unformed hallucinations continued until the tumor of the occipital lobe invaded neighboring structures, at which time formed hallucinations began to occur. Morton Cutler.

Ramirez, A., and Verastegui, P. **Visual fields in cerebral cysticercus.** Ann. de Soc. mex. de oftal. **25**:265-273, Oct.-Dec., 1951.

In Mexico about 25 percent of all cerebral tumor is cysticercus. In the United States and Canada it is about three cases per thousand. In 21 of 77 cases taken at random there were changes in the visual fields. The parasites were found in the fourth ventricle, aqueduct of Sylvius, cisterna magna and at the anterior part of the brain. In 14 cases the location was determined by clinical observation, by X-ray examination and by surgical exploration In 18 cases the field changes were characteristic of lesions in the anterior portion of the visual pathways. In three patients with anterior cysticercosis the field changes could be explained on the basis of direct compression of the visual pathways. Posterior cysticercosis causes internal hydrocephalus and the enlargement of the third ventricle produces direct pressure on the chiasm or it may push the vessels of the circle of Willis against the chiasma. These views were presented by Cushing, Dandy and Puig Solanes. Jose F. Pietri.

Rothschild, F. S., and Streifler, M. **One eyedness in homonymous hemianopia.** J. Nerv. & Ment. Dis. **116**:59-64, July, 1952.

In examining brain injured individuals for "eyedness" (right or left ocular dominance) seven cases of homonymous hemianopia were found and eyedness in each case was homolateral to the hemianopia. Each patient was right handed; four with right homonymous hemianopia were right eyed and three with left were left eyed. Eyedness in general appears to be related to handedness and both seem to be associated with predominance of the corresponding (contralateral) cerebral hemisphere. Hence, it can be assumed, theoretically, that destructive lesions in one hemisphere producing homonymous hemianopia decrease the presence of dominance in the contralateral eye. These seven cases, however, imply that such cortical or subcortical lesions increase, in comparison to the norm, the occurrence of dominance in the contralateral eye. Dominance of the eye homolateral to the hemianopia might be considered as a process of adaptation.

Arthur H. Keeney.

Spalding, J. M. K. **Wounds of the visual pathway: the visual radiation.** J. Neurol. Neurosurg. & Psychiat. **15**:99-109, May, 1952.

From a series of 958 cases of penetrating head injury, 62 were selected in which injury was confined to a part of the visual radiation. The author reports the defects of the visual field after injury to the visual radiation and describes the anatomical deductions which can be made from them. Particular attention is paid to the anterior half of the visual radiation. Two characteristic field defects are associated with wounds of the anterior portion of the radiation: 1. a partial quadrantanopia in which the horizontal meridian is spared and the field defect projects towards the fixation point in the vertical meridian occurs in wounds involving the upper or lower margins of the anterior radiation, and 2. a narrow sector-shaped defect in the horizontal meridian reaching to the fixation point occurs in wounds involving only the intermediate part of the anterior radiation. This sector-shaped defect has not previously been recognized as a possible sequel of a lesion of the visual radiation. The anatomical deduction from such clinical findings is that in the anterior

radiation, fibers subserving central vision are spread out along the entire lateral aspect, tending to congregate at the intermediate part, and fibers subserving peripheral vision spread out along the medial aspect, tending to congregate at the upper and lower margins. (11 figures, references) Mitchell B. Rider.

14

EYEBALL, ORBIT, SINUSES

Chandler, G. N., and Hartfall, S. J. **Cortisone and ACTH in exophthalmic ophthalmoplegia.** Lancet **1**:847-850, April 26, 1952.

Exophthalmic ophthalmoplegia, a disordered function of some or all of the extrinsic ocular muscles, caused by protrusion resulting from increase in the orbital contents, is considered a relatively rare condition. Thyrotoxicosis, the cause of this condition in the five cases reported by the authors, is discussed particularly with regard to the ocular manifestations. Thyroid inhibition by cortisone and ACTH stimulated the authors to investigate the effect of these drugs on two women and three men aged 49 to 79 years. Sodium intake, urine analysis, proptosis measurements, basal metabolic rate and blood cholesterol levels were all observed and recorded. Some improvement was noted in four cases. In the two patients in whom exophthalmos and ophthalmoplegia coexisted, the thyrotoxicosis was controlled by the drugs. One of these showed no recurrence when last seen, three months after the treatment was terminated. Sodium balance studies provided nothing of significant value.

Francis M. Craige.

Elslo, F. L., and v. d. Zwan, A. **Pulsating exophthalmus and von Recklinghausen's disease.** Folia Psychiat. **55**:51-54, Feb., 1952.

A patient, 65 years old, with Recklinghausen's disease, congenital pulsating exophthalmos, bone defect of the orbit and enlarged sella is described. The pulsation is ascribed to a spindle-shaped aneurysm of the carotid syphon. The enlargement of the sella and the bone defect of the orbit are probably the result of the continuous pulsation of the aneurysm and contents of the orbit.

Thomas A. Burns.

Loehlein, Walther. **Internal infiltration of the eye by an inflammatory tumor of the orbit.** Arch. f. Ophth. **152**:389-398, 1952.

A chronic inflammatory tumor of the orbit is described which infiltrated sclera and choroid. Multiple follicles were found consisting of epithelioid and plasma cells. The etiology remained unknown. The reader is reminded that in cases of exophthalmos in addition to Graves' disease and tumors of the hematopoetic system, specific and nonspecific inflammatory tumors must be considered. A biopsy may be necessary. Ernst Schmerl.

Oliver, E. **Plastic procedures in atresic orbital cavities.** Arch. chil. de oftal. **22-23**: 96-97, 1949.

Absence of the inferior conjunctival fornix is a common cause of poor retention of a prosthesis. In four patients, a metallic conformer was successfully employed to stretch the socket when the conjunctival retraction was small. Where there is actual absence of the cul-de-sac, an epithelial transplant is used to reconstruct the fornix, after which the conformer is inserted to maintain the position of the graft. The prosthesis is usually fitted eight to ten days after insertion of the conformer. The results in the reported cases were favorable, with retention of the prosthesis. James W. Brennan.

Richtsmeier, A. J. **Progressive exophthalmos and localized myxedema.** Illinois M. J. **101**:189-193, April, 1952.

The author discusses the subject before presenting a case of his own. Localized myxedema and progressive exophthalmos make up a definite but uncommon syndrome. Thyrotoxic and thyrotropic exophthalmos must be differentiated to decide on the best treatment. He points to the obvious advantages of the use of thiouracil as a therapeutic test in doubtful thyrotoxicosis over the irreversible effects of irradiation or surgery of the thyroid gland. The thiouracil drugs, he feels, have no other value and may be harmful. Mention is made of pituitary irradiation in a report by Thompson in cases of toxic diffuse goiter with progressive exophthalmos or localized myxedema.

Francis M. Crage.

15

EYELIDS, LACRIMAL APPARATUS

Brand, I. **Polyps of the lacrimal sac.** Klin. Monatsbl. f. Augenh. **118**:172-175, 1951.

True polyps which are really papillomas or fibromas are covered with epithelium. The pseudopolyps are granulomas, are not covered with epithelium and have a broad base. True polyps are comparatively rare and they are usually found incidentally. The author reports a case of a soft fibroma which was excised during dacryocystorhinostomy. Frederick C. Blodi.

Esteban Aranguez, Mario. **Surgery for ptosis.** Arch. Soc. oftal. hispano-am. **12**: 269-279, March, 1952.

The author presents a new operation for ptosis, which consists essentially in fixing the levator of the lid to the superior rectus, preserving the integrity of both muscles. The procedure includes an exposure of the tendons of the two muscles through a conjunctival incision in the superior fornix; the tendons are then united with three silk sutures. The merits claimed for this procedure follow 1. It is simple; the difficulty of fashioning a tongue of the superior rectus as in the Motais operation is eliminated. 2. The union of the two muscles is more complete in that both insertions of the elevator of the lid, the cutaneous and the tarsal, are activated by the broad amplitude of the union. 3. The results are more certain. While in the Motais operation the attachment of the tongue of the superior rectus is weak and may be disturbed by a minor pull, the attachment in this procedure is wide and the sutures are imbedded in firm tissue. 4. Better functional results are obtained because of the conservation of the integrity of the superior rectus. 5. Better cosmetic appearance is achieved. The notch following the Motais operation, caused by the traction of the superior rectus at one point, is absent, because traction of the muscle is distributed evenly through the lid. (8 figures)

Ray K. Daily.

Garzino, A. **Oncocytes (picnocytes) in the walls of the lacrimal sac.** Rassegna ital. d'ottal., **21**:125-140, March-April, 1952.

Garzino examined histologically the lacrimal sacs of 54 patients varying in age from newborn to 83 years. Material was taken from the dome, walls and the nasolacrymal duct and was stained with numerous different dyes. In 8 sacs from persons of 42 to 83 years of age the typical oncocytes were found. No such cells were seen in the material of persons under 42 years of age. The oncocytes were present only when signs of inflammation were observed. Cystic adenomatous areas were found in some cases. The article is well illustrated by photomicrographs. (11 figures, 23 references) Eugene M. Blake.

Marin-Amat, M. **A contribution to dacryocystorhinostomy.** Arch. Soc. oftal. hispano-am. **12**:243-269, March, 1952.

The difficulties of this operation are dis-

cussed, the principal one being that of hemorrhage. For its control during the operation, the author ligates the angular vein, applies bone wax to the bone, and sprinkles sulfathiazol powder on the mucous membrane. To prevent postoperative hemorrhage he tampons the nasal fossa with gauze. An adequately large opening, especially above and behind is essential for a successful result. (20 figures) Ray K. Daily.

Oliver, E. **Dacryocystorhinostomy—technique of Valle.** Arch. chil. de oftal. **22-23**:91-96, 1949.

Extirpation of the lacrimal sac should be performed only in exceptional cases. The author prefers dacryocystorhinostomy by the Dupuy-Dutemps procedure as modified by Valle, and has analyzed his experiences with the operation in 105 instances. Epiphora was the main symptom present in the patients who ranged in age from 6 to 75 years. The majority of patients were women. There were only three immediate failures among the 105 operations performed. Prolonged observation was possible in 42 of the patients treated. Of these, patency of the passage remained in 37. The author feels that this technique is easily followed by the surgeon, requires little time (averaging 20 to 40 minutes), and is highly effective.

James W. Brennan.

Raimondo, Nicola. **The dysendocrine nature of primary chronic dacryocystitis.** Ann. di ottal. e clin. ocul. **78**:269-273, April, 1952.

There is indubitable evidence that primary chronic dacryocystitis is due to endocrine dysfunction. Treatment with estrogens is not as effective as irrigation with neostigmine methylsulfate which produces hyperemia by inhibiting the action of cholinesterase and may relieve the chief complaint of epiphora if treatment in longstanding cases is continued for months. Harry K. Messenger.

Roveda, Jose Maria. **Surgical treatment of obstructions of the inferior canaliculus.** Arch. de oftal. de Buenos Aires **26**:510-515, Nov., 1951.

Obstruction of the canaliculi when accompanied by obstruction of the nasolacrimal sac can be treated by dacryocystorhinostomy. The operation gives fairly good results when followed by prolonged probing but it is not correct physiologically and anatomically. In cases of obstruction of the lower canaliculus alone, the operation is not indicated. False passages can be made when trying to probe blindly. In cases of pure lower canaliculus obstruction it is preferable to recanalize with prolonged catherization. The opening of the common canaliculus into the nasolacrimal sac is exposed surgically. The canaliculus is enlarged with Bowman probes or a new opening is made with a sharp probe or a needle. A piece of Guyon filiform or a piece of silver wire two millimeters in diameter is left in place. With the aid of lid movements and manipulation it will cause epithelization of the passage and formation of a permanent fistula. The piece of recanalizing material should be left in place at least ten days and it is better to err with too long a time rather than too short. Periodic probing and irrigations should follow the removal of the recanalizing material. Five cases were treated with this procedure with good results in all of them.

Jose F. Pietri.

Vouters, J. **The tearing eye: an outline of pathogenesis and treatment.** Ann. d'ocul. **185**:515-536, June, 1952.

Hypersecretion of tears, the subject of this paper, is less well understood than inadequate drainage. It is intermittent and therefore less annoying to the patient. Attacks of burning, redness and tearing

occur for which no physical explanation can be found. Cold and wind affect it little, it comes suddenly, sometimes at night, sometimes in response to accommodation or light. All this points to a vasomotor origin. Vouters discusses the anatomy of the lacrymal system and describes the course of the parasympathetic fibers. He analyzes the physiology of continuous reflex and psychogenic lacrimation and the part played by the sympathetic and parasympathetic nerves. For an intelligent understanding of treatment of the weeping eye the function of the spheno-palatine ganglion must be kept in mind. This ganglion regulates the secretion of the mucous glands of the nasopharynx as well as of the tears.

Hypersecretions may be classified in three groups. 1. Those which pass through the centriptal pathways, for example irritation of the trigeminal. 2. Hypersecretions which pass through the sympathetic and parasympathetic centrifugally, which may be a perversion of the lacrimal reflex, as in crocodile tears, or may result from a parasympathetic hyperactivity, as in Horton's syndrome. 3. Hypersecretions in the course of affections of the gland itself. These, to be sure, are very rare. Treatment should be based on physiologic and pathologic considerations. Vouters outlines it as follows. A. Interruption of the centripetal centers. 1. The nerve endings may be acted upon by astringents, by retrobulbar injections of novocaine-alcohol, or by surgery of the ciliary nerves and ciliary ganglion. 2. The nerve endings in the nose may be acted on by anesthesia of the mucous membrane or by action on the sphenopalatine ganglion. 3. Action on the trigeminal nerve by neurosurgery, which is largely of theoretical interest. B. Interruption of centrifugal centers by 1. section of the superficial petrosal nerve, 2. action on the spheno-palatine ganglion, 3. action on the sympathetic, 4. treatment of the dystonia. C. Action on the peripheral organ, that is, the lacrymal gland itself, by the injection of alcohol, diathermy coagulation, radiotherapy and partial or total extirpation. (64 references) B. T. Haessler.

16

TUMORS

Christensen, E., and Ry Andersen, S. **Primary tumours of the optic nerve and chiasm.** Acta Psychiat. et Neurol. **27**:5-16, 1952.

Seventeen verified cases of tumor of the optic nerve and its sheath or the optic chiasm were analyzed. Twelve were gliomas and five meningiomas. Three orbital fibrosarcomas are also mentioned. The average age of the patients with glioma was eight years. The diagnostic features were progressive unilateral visual loss, progressive nonpulsating axial protrusion of the globe, increased resistance to pressure on the eyeball, optic atrophy or papilledema, enlargement of the optic foramen, and sometimes dilatation of the optic groove, and intracranial symptoms. The average age of the patients with meningioma was 45 years. Because of the tendency to penetrate the optic nerve sheath and infiltrate the surrounding tissue, visual loss does not occur early, but restriction of movement, protrusion of the globe, and sometimes pain, do. The same factor causes erosion of the orbital wall rather than dilatation of the optic foramen.

Histopathologic study showed four types of glioma cell. The actual tumor cell, the oligodendrocyte, is of glial origin, probably originating from oligodendroglia. The tumor appears to enlarge the optic nerve. The meningioma on the other hand does not invade the optic nerve, but penetrates the sheath and spreads into the orbit. Both fibroblastic and endotheliomatous meningioma cells were found. The only treatment of these primary tu-

mors is surgical, either by an orbital operation, or craniotomy. The latter is routine when there are intracranial symptoms. (4 figures, 32 references)

Harry Horwich.

François, J., Boels, W., and Rabaey, M. **Metastatic cancers of the choroid, one of which arose in the cortex of the adrenal.** Ann. d'ocul. **185**:497-514, June, 1952.

Three cases are reported. In two middle-aged women cancer of the choroid was secondary to carcinoma of the breast, which had been removed one and a half to two years previously. The third case is of special interest. In a man, 56 years of age, a malignant intraocular tumor was found at a time when there were no signs of disease elsewhere in the body. The eye was enucleated and a diagnosis of metastatic epithelioma, of the alveolar type, was made. The primary tumor could not be found. Four months after he was first seen, the patient died. Autopsy showed a bilateral carcinoma of the adrenal cortex with metastases in the brain, lungs, pleura, mediastinum and long bones, as well as in the choroid. Only one other case of metastasis into the choroid from an adrenal tumor has heretofore been reported. The authors discuss their case in detail, with clinical, autopsy, and histologic findings. (38 photomicrographs, 2 in color, 38 references)

B. T. Haessler.

Moro, Ferruccio. **Researches on the morphobiology of malignant melanomas of the choroid. II: Further studies on the presence of nervous structures in the intraocular neoplastic mass.** Ann. di ottal. e clin. ocul. **78**:287-322, April, 1952.

A study of 12 primary malignant melanomas of the choroid and of 2 carcinomas that had metastasized to the choroid shows that structures of neurogenic origin are almost always present. These are represented by segments of ciliary nerves and of isolated unmyelinated axons grouped into bundles and networks and seemingly quite lacking in cellular elements such as Schwann's or ganglion cells. These nervous elements appear to be unconnected with either the cells or the blood vessels of the tumor and to be functionless. They are thought to be either pre-existent nerves of the choroid that have become incarcerated in the tumor or else new-formed structures representing a limited attempt at regeneration on the part of still vital pre-existent nerve fibers interrupted and partially destroyed by degenerative processes within the tumor. The controversy as to the histogenesis of these tumors still remains unsettled. The presence of nervous structures both pre-existent and new-formed fits any of the various theories. (18 photomicrographs; references)

Harry K. Messenger.

Page, P., Betoulières, and Cazaban, R. **The isolated form of fronto-orbital plasmocytoma.** Ann. d'ocul. **185**:632-639, July, 1952.

Plasmocytoma is a very rare form of myeloma in which only plasmocytes are present. Myeloma is an encapsulated slow growing tumor which tends to become multiple and which contains leucocytes and lymphocytes derived from bone marrow. The authors' case concerns the left eye of a 40-year-old man with severe exophthalmus and displacement downward of the left eye. Ocular motility and sensitivity were normal; the right eye was normal. The only positive biologic findings were slightly increased protein and alpha globulin content of the blood. Radiologically a large circumscribed mass was observed adherent to the roof of the orbit and involving the frontal sinus as well as the meninges. Surgical removal was accomplished, the details of which are not mentioned.

Chas. A. Bahn.

deVeer, J. A. **Possible malignant melanoma of choroid.** A.M.A. Arch. Ophth. **47**:734-744, June, 1952.

This is a case report with photomicrographs of sections through an eye containing a small melanotic tumor. An unequivocal diagnosis of malignancy could not be made, but the case illustrates the justification for removing hopelessly blind eyes. The author suggests that when such eyes are encountered in childhood, enucleation should be done before puberty. Malignant melanomas of the uvea and skin are almost unknown before adolescence. George S. Tyner.

17

INJURIES

Linhart, W. O. **Penetrating and perforating wounds of the eye.** Pennsylvania M. J. **55**:421-424, May, 1952.

In all conjunctival wounds an underlying scleral wound may be present and should be explored in detail. Large perforations should be repaired under general anesthesia. Corneal wounds may be closed with 6-0 black silk and the sclera with 5-0 plain catgut. Iris prolapse should be resected. Immediate closure of all large ocular perforations is necessary. An X-ray study of every perforated eye is necessary in order to rule out the possibility of an intraocular foreign body.

Irwin E. Gaynon.

Marin-Amat, M. **An interesting case of an intraocular foreign body.** Arch. Soc. oftal. hispano-am. **12**:493-497, May, 1952.

A case of intraocular iron splinter which penetrated the upper lid and sclera, and lodged in the vitreous is described. There was a total loss of vision, attributed partially to the hemorrhage into the vitreous, and partially to an inflammatory process within the globe. The foreign body was extracted with a magnet and lactoprotein and penicillin were administered during the postoperative course. The eye recovered with 2/3 visual acuity. The author believes that the penicillin and lactoprotein saved the eyeball from panophthalmitis, which usually follows the penetration of foreign bodies contaminated with soil. Ray K. Daily.

O'Reilly, G. **Intraocular foreign bodies.** Arch. chil. de oftal. **22-23**:79-84, 1949.

The magnetic quality of an intra-ocular foreign body is the most important factor in the successful management of such injuries. Nonmagnetic particles require a different mode of treatment and their extraction fails more often. Smaller particles and those particles deep in the vitreous respond with greater difficulty, as do particles containing an alloy. A fibroblastic reaction occurs around the particle in several days and reduces the magnetic response.

Radiographic localization before surgical extraction is advisable. The method of Norman, using a limbal ring sutured to the conjunctiva is preferred. Other methods of localization, have their limitations, although the Berman locator is of great value during surgery.

The route of extraction is governed by the point of entry, the location of the foreign body and the structures damaged. The prevalent theory that all foreign bodies must be drawn forward and thence extracted via the anterior route must be revised; the posterior route is safer, easier, and more successful. Particles in the anterior chamber or lens are removed by an anterior route, otherwise the extraction of choice follows the shortest and most direct approach. Application of diathermy around the scleral incision is prophylactic for retinal detachment. Figures are presented to indicate that up to 82 percent of foreign bodies may be extracted by the posterior route. It is emphasized that extraction is not synonymous with cure, as the elements of infection, hemorrhage, de-

tachment, and cataract may play a role in the restoration of vision. The increased use of aluminum makes treatment more difficult, as it reduces the magnetic quality of iron and steel, although it is well tolerated by the eye. James W. Brennan.

Santander, D. **Penetrating wounds of the eye.** Arch. chil. de oftal. **22-23**:85-89, 1949.

The author gives a statistical analysis of his experience in treating 94 perforating wounds of the globe. When the wound involves the cornea alone, the prognosis is much better than when the sclera is involved. An attempt is usually made to save the globe by excision of any prolapsed iris, closure of the corneal wound, and extraction of the lens if indicated, and covering with a conjunctival flap. Foreign bodies are extracted, of course. Wounds involving the sclera alone are less favorable; enucleation became necessary in 50 percent. Corneo-scleral wounds are less common but most serious; 75 percent required enucleation. Delay in seeking medical attention is a factor in the poor result. Sympathetic ophthalmia was diagnosed in three patients, but was not confirmed by pathologic examination. The value of penicillin in treating infections associated with these injuries is difficult to evaluate. It was not available for patients seen during the early stages of the investigation, and of doubtful value in severe infections. James W. Brennan.

Vail, Derrick. **Treatment of burns of the eyes.** Am. J. Surg. **83**:615-616, May, 1952.

The lids, because of their anatomic structure and blood supply, rarely suffer extensive necrosis. Conservative therapy with ointments and dressings usually suffices. When injury is so extensive as to endanger the eye, protection with skin flaps or tenotomy is necessary.

The cornea suffers least in thermic or radiation burns. Chemical burns give rise to a delayed reaction on the deeper structures. The author is quite specific in stating that to wait to neutralize the chemical agent results in loss of time and further insult to the tissues. He recommends the treatment advocated by McLaughlin which is as follows. 1. Holding the lids open, the eye is washed thoroughly with tap water. No neutralization is attempted nor are foreign particles removed. 2. After transportation to the hospital or dispensary the eye is anesthetized, particles removed and the eye irrigated with saline solution. 3. If necrosis is evident, the ophthalmologist removes the defective epithelium; 4 percent cocaine solution is used locally. Thomas A. Burns.

18

SYSTEMIC DISEASE AND PARASITES

Chinaglia, V. **Clinical and histologic study of a case of hydroa vacciniforme with ocular manifestations.** Ann. di ottal. e clin. ocul. **78**:341-362, May, 1952.

Chinaglia describes a case of Bazin's hydroa vacciniforme, or summer prurigo. The patient, a 46-year-old man with porphyrinuria, had had characteristic skin manifestations since he was three years old and keratoconjunctivitis since he was eight. Each cornea showed deep scars, with hypesthesia and a yellowish reflex in the scarred region. The limbus was vascularized and new vessels had formed in the conjunctiva. The general aspects of the disease are discussed, with particular reference to the metabolism of porphyrins and to analogies with vernal conjunctivitis, and the literature is briefly reviewed. (7 figures, references)

Harry K. Messenger.

Cüppers, C. **Ocular signs in temporal arteritis.** Klin. Monatsbl. f. Augenh. **118**: 645-647, 1951.

The first case of temporal arteritis to be

reported in Germany is described. Papilledema was present. Biopsy of the artery confirmed the diagnosis.

Frederick C. Blodi.

Douglas, H. A. **A case of the syndrome of Fanconi.** Tr. Ophth. Soc. U. Kingdom **70**:98-100, 1950.

A small girl with fair hair and skin, nine months of age, became ill with thirst, polyuria and poor appetite and at two years of age developed photophobia. She had been treated for rickets since infancy with vitamin D. Fanconi in 1936 described renal dwarfism as an early infantile nephrotic-glycosuric dwarfism with rickets of low phosphorus type, in contra-distinction to the usual form of renal rickets in which the blood calcium is low. The marked photophobia seemed to be due to the studding of the entire conjunctiva with masses of crystals. The cornea appeared to have an opacity like a window lightly breathed upon. Uniformly distributed throughout the substantia propia, but not in Bowman's or Descemet's membranes were needle-like crystals which have polychromatic lustre and glow red, green, blue and yellow like hoar frost in the sun. Crystals were also found in the iris. An associated epithelial dystrophy was reported in two other patients. The condition is hypothetically ascribed to a disorder of amino-acid metabolism. Cystine is found in the reticulo-endothelial system especially the liver, lymph nodes, spleen, bone marrow and kidneys. Storage of cystine is characteristic of the disease.

Beulah Cushman.

Fanta, H. **The histology of the eye in typhus fever.** Arch. f. Ophth. **151**:735-743, 1951.

Microscopic study of a pair of eyes revealed perivascular infiltration of small cells, damage to the vascular walls and thrombus formation. Schlemm's canal, iris and ciliary body showed changes, whereas an iritis had never been observed in living patients. In the retina and choroid the perivascular infiltration was often combined with changes and increase in the cells of the intima. Loss of the pigment epithelium and hemorrhages into the inner layers of the retina were repeatedly seen. The perivascular infiltration was pronounced around the vessels of the optic nerve.

Ernst Schmerl.

Fontaine, Martine. **The ocular symptoms of myasthenia.** Arch. d'opht. **12**:157-169, 1952.

The author describes the general aspects of myasthenia and analyzes the ocular findings in 17 cases. He found ptosis to be the most frequent ocular sign. It was present in 12 of the 17 cases and the initial sign of the disease in 9 cases. Although for the most part bilateral, the ptosis was usually more marked on one side. Variability in the degree of the ptosis was characteristic. Weakness of the orbicularis was observed in 14 of the 17 cases and inability to close the lids occurred in 2 cases in which it was the initial symptom. No pupillary disturbances were noted in any of the patients but important weakness of accommodation was found in 6 and minor weakness in 3. The powers of convergence and divergence showed rapid fatigue in patients without diplopia, and phorias were subject to unusual variations. The visual fields were generally contracted but could be enlarged in early cases by the use of prostigmine. In order of frequency the rectus muscles were involved as follows: the superior rectus, the external rectus, the internal rectus, and the inferior rectus.

Fontaine concludes that all cases of myasthenia exhibit modifications in the ocular musculature of either the fatigue type or the paresis type, and that ocular symptoms, either ptosis or diplopia, mark the onset of the disease in more than half

the cases. He discusses fully the important principles of diagnosis and therapy.

P. Thygeson.

François, J. **Estrogen therapy of the oculo-palpebral symptoms of Basedow's disease.** Acta ophth. **29**:423-444, 1951.

From an experience gained from estrogen therapy in eight cases of exophthalmos with retraction of the upper lid and paresis of the extraocular muscles, François concludes that the disturbances in ocular motility, as well as the exophthalmos, are caused by an excess of thyrotropic hormone. This view is confirmed by the clinical effect of estrogen therapy, which inhibits the action of the hypophysis and the production of thyrotropic hormone. Estrogens should be given in large doses for a long time, and therapeutic failure in some of his cases is attributed by François to inadequate therapy. Ray K. Daily.

Galindez-Iglesias, F., and Lafuente, A. **Changes in the anterior pole of the eye in hypercalcemia.** Arch. Soc. oftal. hispano-am. **12**:499-505, May, 1952.

The author reports a case of hypercalcemia due to hyperparathyroidism with bilateral conjunctival nodules. The patient also had an ossifying miositis. Chemical examination of a conjunctival nodule showed that it consisted of tricalcium phosphate. The literature on ocular symptoms in hypercalcemia is reviewed.

Ray K. Daily.

Hager, H. **Ocular involvement in thromboangiitis obliterans.** Klin. Monatsbl. f. Augenh. **118**:147-155, 1951.

Two patients with severe thromboangiitis obliterans are presented. Bilateral cataract suddenly developed in both patients. In addition these patients showed capillary loops on the disc and at the limbus. The author gives a survey of all ocular signs observed with thromboangiitis. Frederick C. Blodi.

Hatch, Harvey A. **Myasthenia gravis: report of a case with exophthalmos without hyperthyroidism, relieved with neostigmine.** New England J. Med. **246**:856-858, May 29, 1952.

A patient with typical myasthenia gravis without hyperthyroidism but with exophthalmos was promptly relieved by prostigmine. There may not have been a true exophthalmos but merely a widening of the palpebral fissures.

Irwin E. Gaynon.

Narog, F. **Additional statistical data and observation from eye consultation in tuberculous meningitis and miliary tuberculosis in children treated with streptomycin.** Klinika Oczna **22**:45-48, 1952.

The author reports his observation of 118 patients with tuberculous meningitis and 36 patients with miliary tuberculosis for 1½ years; 56 died and 39 improved. Paralysis of muscles were seen in 11 patients, paralytic mydriasis in 66, nystagmus in 74, proptosis in 12, optic neuritis in 17, choked disk in 24, pallor of the disk in 25, atrophy of the optic nerve in 9, and tubercles of the choroid in 23 cases. Streptomycin is considered to be the best agent in treatment of tuberculosis but overdosage may act adversely. Improvements were seen most frequently in recent infection. Sylvan Brandon.

Obal, Adalbert. **The effect of malnutrition upon the eye.** Arch. f. Ophth. **151**: 623-661, 1951.

Between 1945 and now the author studied 57 patients with malnutrition. He found signs of polyneuritis, hemeralopia, nyctalopia, diminished local adaptation of the retina and central and paracentral scotomas. A superficial keratitis similar to epidemic keratoconjunctivitis was repeatedly seen. Disturbances of color

vision, especially for red and green, developed together with central scotomas. Often a temporal pallor of the discs became noticeable. Treatment consisted of a diet rich in protein; vitamin A, lactoflavin and follicle hormones seemed to be of some value. Ernst Schmerl.

Parsons, H. E. **Nematode chorioretinitis.** A.M.A. Arch. Ophth. **47**:799-800, June, 1952.

The author reports a case in which a viable subretinal worm was observed and photographed. The parasite is believed to be an Ascaris although no worms were found in the stools. George S. Tyner.

Straub, Wolfgang. **Our experiences with the ocular toxoplasmosis of adults.** Klin. Monatsbl. f. Augenh. **118**:483-499, 1951.

The authors present 27 patients with adult toxoplasmosis. The clinical picture varied and the following entities occurred: iridocyclitis, retinal hemorrhages, chorioretinitis, Coats' disease, and angioid streaks. The only proof for the diagnosis was a single dye-test (Sabin-Feldman). No complement fixing tests were done, nor was an increase in titer observed.

Frederick C. Blodi.

19

CONGENITAL DEFORMITIES, HEREDITY

Carreras Matas, Marcello. **An unusual case of persistent hyaloid artery.** Arch. Soc. oftal. hispano-am. **12**:614-621, June, 1952.

The author describes a case of persistent hyaloid artery in a child 11 years old, with profound changes in adjacent areas of the fundus. In the inverted image the picture simulated Jensen's juxtapapillary choroiditis, and in the direct image a cysticercus, encapsulated in the vitreous close to the optic disc. Vision was reduced to perception of hand movements, and the eye was divergent. The forms of persistent hyaloid artery are discussed, with special reference to the rarer forms accompanied by changes in the fundus, as in this case. (7 figures) Ray K. Daily.

Jaeger, Wolfgang. **The problem of the localization of the genes in disturbances of color vision.** Arch. f. Ophth. **152**:385-388, 1952.

One of two brothers showed protanopia combined with hemophilia, the other protanomalous trichromasia and normal coagulation of the blood. This finding is said to support the view that the type of disturbance of color vision is determined by one gene, while the degree of disturbance is determined by another gene.

Ernest Schmerl.

Jaeger, Wolfgang. **Recessively sex-linked disturbances of red-green color vision.** Arch. f. Ophth. **152**:379-384, 1952.

A family is reported in which the mother and one son have deuteranomaly, while another son has normal color vision. One brother and the father of the mother are also deuteranopic. To explain the normal color vision of the one son the author offers the suggestion that either a mutation or an elimination of the maternal X-chromosome took place, or that an abnormal dominance characterized the mother. Ernst Schmerl.

Paez Allende, Francisco S. **Marfan's disease, presentation of three new patients.** Arch. oftal. Buenos Aires **26**:47-57, Jan.-Feb., 1951.

The author describes a mother, a son and a daughter, all of whom showed the Marfan syndrome (unusual height, very long hands, fingers, feet and toes, and subluxated crystalline lenses). Four of her brothers, similarly deformed, are described by the mother.

Joseph I. Pascal.

Penzani, B. **A case of congenital lacrimal fistula.** Ann. di ottal. e clin. ocul. **78**: 255-258, April, 1952.

In this case described by Penzani the origin of the fistula is ascribed to an anomalous lateral gemmation, occurring during the embryonic stage, of the primitive solid rod of epithelial cells which is the rudiment of the nasolacrimal duct. (References) Harry K. Messenger.

Rabadan Fernandez, Pedro. **Bilateral congenital malformation of the conjunctiva with microcornea, coloboma of the left lid and other facial abnormalities.** Arch. Soc. oftal. hispano-am. **12**:391-394, April, 1952.

A three-year-old child is described who had bilateral congenital malformation of both eyes, consisting of a coloboma of the external canthus, from which a thick conjunctival band extended toward the cornea and invaded its peripheral 3 mm. In addition the child had microcornea on the left side, hemiatrophy of the right side of the face, and defects in other parts of the body. The author attributes these malformations to a maternal lack of vitamin A. (1 figure) Ray K. Daily.

Tobar, V. **Lipochondrodystrophy, dysostosis multiplex.** Arch. chil. de oftal. **22-23**:125-127, Nov.-Dec., 1949.

A case of gargoylism or Hurler's syndrome, which is rare, congenital, and familial, is described. It is characterized by deposits of lipoid in various tissues, including the cornea, as well as a disturbance of cartilaginous development. First manifestations appear early in infancy, although macrocephaly may be present at birth. Kyphosis and abnormal growth of the head soon follow, and there is delayed walking, talking and eating. The clinical picture is generally complete by the age of four. The Gargoyle-like appearance is quite characteristic. The broad face, proptosis, saddle nose, thick lips and tongue, short neck, umbilical hernia, multiple skeletal deformities, and mental deficiency are conspicuous. Life expectancy is short. Homogeneous, gray avascular opacities in the deeper central portion of the cornea are observed in both eyes in 75 percent of cases. There are no signs of inflammation. Microscopic examination of three patients indicated that the infiltration is behind Bowman's membrane, which is abnormally thin and ruptured in places. The substance is probably natural lipoid. The eye lesion may be classified as a corneal dystrophy.

James W. Brennan.

De Vincentiis, M. **Morphogenetic study of the optic vesicle in the light of a case of ocular teratoma.** Rassegna ital. d'ottal. **20**:323-324, Sept.-Oct., 1951.

A boy, otherwise normal, had what seemed to be a conjunctival cyst in the right lid. Upon removal of this mass, an incision in the cyst wall freed a whitish fluid and a small corpuscular body. Microscopically the latter showed the picture of the ocular structures, especially the lens and retina. This appears to be a unique case of an eye in the state of development implanted upon a normal eye.

Eugene M. Blake.

Wettler, H. **Ocular symptoms in gargoylism.** Ophthalmologica **123**:338-342, April-May, 1952.

Four patients with typical gargoyle faces and characteristic lipoid corneal deposits are described. Peter C. Kronfeld.

Weigelin, S. **Two cases of congenital anophthalmos.** Klin. Monatsbl. f. Augenh. **118**:639-640, 1951.

One child had bilateral, the other unilateral, anophthalmos.

Frederick C. Blodi.

Wiederhold, A. **Congenital malformations associated with rubeola.** Arch. chil. de oftal. **22-23**:5-26, 1949.

The possible relationship between German measles and congenital malformations was observed in Australia in 1940 by Gregg and it is generally accepted that the virus of rubeola causes the embryopathy. The Australian investigators feel that infection during the first or second month of pregnancy will involve the fetus in 100 percent of cases because the first trimester is devoted primarily to organogenesis, while the latter two trimesters are concerned with growth of the previously formed organs. The most commonly observed anomalies are cataract and microphthalmia, deafness, heart disease, microcephaly and mental deficiency. Of these, deafness occurs most often. Dental defects, hernia, hypospadias, cryptorchidism and mongolism are also seen.

The cataract may be unilateral or bilateral, and is usually a central opacity in the nucleus. The lens is abnormally small, and, in pathologic specimens, the cortical material stains poorly. The critical period of development is the stage of differentiation of primary and secondary lens fibers, from approximately the fourth to the eighth week. The cataract may be associated with microphthalmia, which is a partial manifestation of microcephaly, atrophy of dilator fibers in the iris, pigmentary disturbances in the retina, and anomalies of the canal of Schlemm. A detailed case report is presented, including reproductions of X rays, electrocardiogram, and photographs of the patient.

James W. Brennan.

20

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Esser, A. **The emerald of the Emperor Nero.** Klin. Monatsbl. f. Augenh. **118**:185-187, 1951.

Pliny mentions that Nero watched the gladiators with an emerald. This statement has been differently interpreted by various authors. The emerald was probably used as a concave mirror which enabled the emperor, lying on a couch, to follow the events in the arena.

Frederick C. Blodi.

Mercier, A. **Is fluorescent lighting harmful to vision?** Ann. d'ocul. **185**:577-787, July, 1952.

Fluorescent lighting is not harmful to normally sensitive eyes if the installation is reasonably designed. Most of the complaints concerning fluorescent illumination are due to defective installation and individual hypersensitivity, especially to short wave light. Both the pallor or cadaveric appearance and glare which are complained of are basically due to the relative absence of red and yellow in fluorescent lighting. The remedy obviously consists in using properly tinted tubes such as the daylight type and appropriate shades and other surroundings to increase the red and yellow light values. Flickering, especially when fluorescent lighting begins, is primarily due to imperfect installation in the transformer or in the tube arrangement. The reduced shadow values observed with the fluorescent lighting do not interfere with visual efficiency except in a few vocations such as painting, where shadows may be of major importance. Excessive ocular fatigue following prolonged accurate fixation with fluorescent lighting is due to imperfect installation or individual hypersensitivity, usually caused by refractive errors, or is a part of a general, mental and physical hypersensitivity. The minimum intensity of illumination for prolonged close work is 35-40 foot candles on working surfaces and the reflection from surrounding walls, floors, ceiling and furniture should not exceed 50 percent.

Chas. A. Bahn.

Sabbadini, D. **The present status of ophthalmic accident insurance in Italy.**

Rassegna ital. d'ottal. **20**:263-279, Sept.-Oct., 1951.

The author reviews the laws which exist in Italy for compensation for eye injuries which have been instituted since a former discussion of the subject in 1920.

Eugene M. Blake.

Santoni, A. **Certain statistical factors concerning the incidence of trachoma at the Naples Clinic during the years 1938 to 1950.** Riv. ital. del trac. e di pat. ocul. esot. **3**:5-20, Jan.-March, 1951.

The decrease in the total number of trachoma patients at the Naples Clinic which occurred after 1948 can probably be ascribed to an increase in the number of clinics in the country and the reorganization of the trachoma service. More women patients were seen, and a greater number of patients were seen during the spring and summer months. A higher percentage of younger patients was seen, probably because of increased understanding of the importance of care.

Francis P. Guida.

Tabone, A. **Antitrachoma campaign in Gozo.** Riv. ital. del trac. e di pat. ocul. esot. **3**:47-52, April-June, 1951.

An intensive antitrachoma drive was carried out on the Island of Gozo. All primary school children, their contacts, and many of the general population were examined. Free treatment was given to those found to be infected. Sulphonamides were given by mouth for one or more periods of ten days each. In two years only six out of 721 cases were under treatment. Sulphonamides are valuable in the fight against trachoma, but a shorter method of control is needed.

Francis P. Guida.

Tóth, Zoltán. **Is Credé's prophylaxis still timely?** Klin. Monatsbl. f. Augenh. **118**:613-620, 1951.

The author argues against Crede's prophylaxis which he believes untimely and unnecessary.

Frederick C. Blodi.

Tronge, Manuel F. Mendez. **Sichel, oculist to San Martin.** Arch. oftal. Buenos Aires **26**:7-14, Jan.-Feb., 1951.

The year 1950 was the centennial of the death in France of the great Argentinian hero, General San Martin. The general had had various afflictions of the eyes (iritis) and towards the end of his life developed cataract in both eyes. He was treated and operated on by the "most famous oculist in France," Dr. Julio Sichel. There are several historical references on cataract operations and a brief account of the work and accomplishments, literary and clinical, of Dr. Sichel.

Joseph I. Pascal.

Wirth, A. **Psychologic problems in amblyopia.** Ann. di ottal. e clin. ocul. **78**: 131-136, Feb., 1952.

By amblyopia Wirth means partial or complete blindness of both eyes. It is a condition involving more than the mere loss of visual function and is to be regarded as a defect which radically alters a person's entire mental state. Views of others who have dealt with these problems are summarized. Wirth stresses the need of a definite program of study in order to put our knowledge on a firm scientific basis.

Harry K. Messenger.

Zeppa, Rosario. **The colonies and the struggle against trachoma.** Riv. ital. del trac. e di pat. ocul. esot. **3**:113-117, Oct.-Dec., 1951.

Environment is such an important factor in the spread and the evolution of trachoma, that the struggle for its control should be included with the problem of physical and moral education of the children. The colonies not only show a higher percentage of cures but are also more successful in the education of the children.

Francis P. Guida.

NEWS ITEMS

Edited by Donald J. Lyle, M.D.
601 Union Trust Building, Cincinnati 2

News items should reach the editor by the 12th of the month but, to receive adequate publicity, notices of postgraduate courses, meetings, and so forth should be received at least three months before the date of occurrence.

Deaths

Dr. Herman Paul Grossman, Providence, Rhode Island, died June 5, 1952, aged 52 years.

Dr. Everett C. Moulton, Fort Smith, Arkansas, who died on July 19, 1952, at the age of 62 years, was graduated from Northwestern University School of Medicine in 1914. During World War I, he served under Dr. Meyer Wiener at the Cape May (New Jersey) Eye Center. In 1919, he became associated with his father, Dr. Herbert Moulton, in the practice of ophthalmology at Fort Smith. He was certified by the American Board of Ophthalmology in 1922. He was a member of the American Medical Association and a life member of the American Academy of Ophthalmology and Otolaryngology.

Dr. Moulton's death leaves a void in the field of ophthalmology in the areas of western Arkansas and eastern Oklahoma which he served. He is survived by his wife, one daughter, and his son, Dr. Everett C. Moulton, Jr., who represents the third direct generation of the family to practice ophthalmology at Fort Smith.

Announcements

Florida seminar

The seventh annual University of Florida Midwinter Seminar in Ophthalmology and Octolaryngology will convene January 12th and continue through January 17, 1953. As in previous years, Miami Beach will be the host city.

The lectures on ophthalmology will be presented on January 12th, 13th and 14th and the lectures will include such distinguished teachers as Dr. I. S. Tassman, Philadelphia; Dr. Brittain Payne, New York; Dr. Charles E. Illiff, Baltimore; Dr. Lawrence T. Post, St. Louis; and Dr. Walter S. Atkinson, Watertown, New York.

On Wednesday evening, January 14th, all registrants are cordially invited to attend the midwinter convention of the Florida Society of Ophthalmology and Otolaryngology, which meets concurrently with the seminar. (A certificate of attendance at the convention will be issued for deduction purposes.) Outstanding discussions will be presented at that time.

All meetings will be held at the Sans Souci Hotel. The registration fee for the seminar is $40.00. A check of $10.00, payable to the University of Florida Midwinter Seminar, must accompany your application. This is not returnable. The remainder of the registration fee will be paid at the seminar desk at the Sans Souci Hotel on arrival. Representing the division of ophthalmology are: Dr. Shaler Richardson, Jacksonville; Dr. Nelson M. Black, Miami; Dr. Charles Boyd, Jacksonville; and Dr. Bascom Palmer, Miami.

Stanford postgraduate conference

The Stanford University School of Medicine will present the annual postgraduate conference in clinical ophthalmology from March 23 through 27, 1953. The program this year will be devoted to "Ophthalmic surgery." Registration will be open to physicians who limit their practice to the treatment of diseases of the eye or eye, ear, nose, and throat. In order to allow free discussion by members of the conference, registration will be limited to 30 physicians.

Instructors will be Dr. A. Edward Maumenee, Dr. Dohrmann K. Pischel, Dr. Jerome W. Bettman, Dr. Max Fine, Dr. Earle H. McBain, and Dr. Arthur J. Jampolsky.

Programs and further information may be obtained from the Office of the Dean, Stanford University School of Medicine, 2398 Sacramento Street, San Francisco 15, California.

Societies

Georgia meeting

The Georgia Society of Ophthalmology and Otolaryngology will hold its spring meeting at the General Oglethorpe Hotel in Savannah, Georgia, on March 6 and 7, 1953. The following outstanding and internationally known teachers will be the speakers: Dr. Peter C. Kronfeld, Chicago; Dr. Edmund B. Spaeth, Philadelphia; Dr. Frank B. Walsh, Baltimore; Dr. Louis H. Clerf, Philadelphia; Dr. Edmund P. Fowler, Jr., New York; and Dr. Theo E. Walsh, St. Louis. Correspond with the hotel for reservations. For any other desired information, write to the society's secretary, Dr. Alton V. Hallum, 245 Doctors Building, Atlanta, Georgia.

Meeting at Memphis

Dr. Albert D. Ruedemann, Detroit, Dr. C. Wilbur Rucker, Rochester, Minnesota, and Dr. Willis S. Knighton, New York, will be the guest speakers in ophthalmology at the annual convention of the Memphis Eye, Ear, Nose, and Throat Society to be held at Memphis on February 7, 8, and 9, 1953.

United Kingdom congress

The annual congress of the Ophthalmological Society of the United Kingdom will be held at the Royal Society of Medicine, 1 Wimpole Street, London, W.1, on April 23, 24, and 25, 1953.

The presidential address will be delivered by Mr. Alex. MacRae, on Thursday, April 23rd, at 10 a.m.

The subject for discussion will be "The scope of antibiotics and chemotherapeutic agents in ophthalmology." This will be opened by Prof. Arnold Sorsby, Prof. Robert Cruickshank, and Mr. Derek Ainslie. Members who wish to take part in the subsequent discussion are advised to intimate their intention before the opening of the congress. It is emphasized that no member may speak for more than 10 minutes.

On this occasion the Bowman Lecture will be delivered by Prof. Sir Geoffrey Jefferson, C.B.E., F.R.S.

Members wishing to read a short paper are asked to send the title, together with an abstract, to Mr. Leigh not later than December 31, 1952. Those wishing to show films should also communicate with Mr. Leigh by the same date.

Friday afternoon will be devoted to the television of operations at the Moorfields, Westminster, and Central Eye Hospitals (Moorfields Branch).

The annual dinner will be held at the Trocadero Restaurant on Thursday, April 23rd. Members may bring guests.

A trade exhibition will be held in the Cowdray Hall (next door to the Royal Society of Medicine).

On account of the difficulty in obtaining hotel accommodation in London, all members who will require it are advised to make their arrangements in good time. Honorary Secretaries: Mr. Harold Ridley (Council Business); Mr. A. G. Leigh (Congress Business).

Canadian Society officers

At the recent 15th annual meeting of the Canadian Ophthalmological Society, the following officers were elected: President, Dr. Kenneth B. Johnston, Montreal, Quebec; vice-president, Dr. Mark Robert Marshal, Edmonton, Alberta; secretary, Dr. R. G. C. Kelly, 113 St. Clair Avenue W., Toronto, Ontario; treasurer, Dr. J. V. V. Nicholls, Montreal, Quebec.

Milwaukee elections

At the annual business meeting of the Milwaukee Oto-Ophthalmic Society the following officers were elected for the year 1952-1953: President, Dr. Gerhard Straus; vice-president, Dr. Howard High; secretary, Dr. Erwin E. Grossmann.

New Orleans convention

The midwinter convention of the New Orleans Academy of Ophthalmology will be held in New Orleans January 25 to 30, 1953. A symposium on "Medical ophthalmology," will be featured at the meeting.

Personals

Dr. Conrad Berens, New York, delivered the fifth William Hamlin Wilder Memorial Lecture of the Institute of Medicine of Chicago before a joint meeting of the Institute of Medicine of Chicago and the Chicago Ophthalmological Society on October 17th. The subject of Dr. Berens' address was "Relation between research in ophthalmology and advances in medicine."

Dr. Joseph I. Pascal, New York, is giving a series of lectures on "Advanced physiologic optics" to the resident staff at the New York Eye and Ear Infirmary.

Dr. Alston Callahan, Birmingham, Alabama, and Dr. Algernon B. Reese, New York, will be honor guests at the 1953 spring clinical conference of the Dallas Southern Clinical Society to be held in Dallas on March 16, 17, 18 and 19, 1953.

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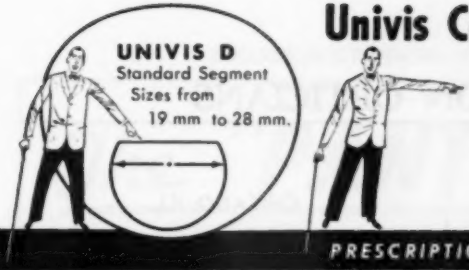

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